California Environmental Protection Agency

Air Resources Board

Sampling for Airborne Naturally Occurring Asbestos at Oak Ridge High School June 2003

Prepared by:
Operations Planning and Assessment Section
Quality Management Branch
Monitoring and Laboratory Division

November 6, 2003

OAK RIDGE HIGH SCHOOL AIRBORNE NATURALLY OCCURRING ASBESTOS SAMPLING REPORT

EXECUTIVE SUMMARY

At the request of the El Dorado County Air Quality Management District (EDCAQMD), the Air Resources Board's (ARB) Monitoring and Laboratory Division (MLD) performed ambient airborne asbestos sampling at Oak Ridge High School located in El Dorado County. This sampling was conducted to assess the nature and extent of asbestos fibers released during mitigation of naturally occurring asbestos (NOA) while completing the school's soccer fields. Mitigation consisted of covering asbestos containing soils and slopes with dirt, grass, concrete, etc., as appropriate for the site, as well as preventing dust emissions by wetting all soils present on the fields and soils brought to the fields.

Sampling was conducted for seventeen days beginning June 16, 2003 and ending on July 10, 2003. A fenceline network of samplers collected 10-hour duration samples around the soccer fields specifically to address construction/mitigation activities. A receptor network collected 23-hour duration samples at the school's basketball courts, tennis courts, and at a home located at the cul de sac south of the soccer fields. The purpose of the long duration samples was to better understand exposure to nearby residents from NOA that may leave the worksite during the construction. There were seventeen samplers in operation.

- The construction activities at the ORHS soccer field took place in an area where naturally occurring asbestos was shown to be present. Elevated ambient levels of asbestos would be expected during the field construction in the absence of proper mitigation. The project was subject to Title 17, California Code of Regulations, section 93105, Asbestos Airborne Toxic Control Measure (ATCM) for Construction, Grading, Quarrying, and Surface Mining Operations. Therefore mitigation during construction was required.

- Ambient monitoring specific to asbestos was performed during all phases of construction. Samples were taken at the edge of the field, near residences, and at locations the students and public usually had access. These areas were closed during construction. During this time, the field was encapsulated with fabric blanket, two feet of certified asbestos free soil was added to the original field surface, a fence was constructed, and various slope and drainage facilities were built.

- Periodic asbestos fibers present in the air samples collected during the soccer field construction were caused by traffic on the field, grading, covering, drilling, and other activities of this project. The readings obtained during the construction do not represent air quality at the present time, rather a worst case scenario of exposure during the time NOA bearing soils were disturbed. The results indicate the ATCM effectively minimized asbestos concentrations on and off the construction site.

- Sample analysis was by transmission electron microscope (TEM) following the AHERA method (40 CFR Part 763, Subpart E) with ARB modifications. Asbestos could be detected at levels 40 times lower than the AHERA classroom clearance criteria used to permit rooms to be reoccupied after asbestos removal (0.0005 versus 0.0200 structures per cubic centimeters or s/cc).

- Of the 224 samples obtained during the field construction:

    - The maximum level recorded (0.0039 s/cc) was approximately five times lower than the AHERA classroom clearance level (0.02 s/cc).

    - The average concentration of all samples was 0.0008 s/cc, or about twice the detection limit of the method. The average receptor site concentration (off of the construction site) was at the level of detection, 0.0005 s/cc. The average on site concentration was approximately 0.0010 s/cc.

    - Thirty-seven percent of the samples had ambient asbestos concentrations below the method level of detection (0.0005 s/cc).

    - Five percent of samples were above 0.0020 s/cc, which is ten times lower than the classroom clearance level.

- Eighty percent of the asbestos concentrations at the receptor sites were below the level of detection.

    - Chrysotile, tremolite, actinolite, and anthophyllite were the types of asbestos detected. Tremolite was found in 11 of the 140 samples that had detectable asbestos. Actinolite was the prevalent type of asbestos detected.

This report details the sampling strategy and results of sampling at Oak Ridge High School.

OAK RIDGE HIGH SCHOOL AIRBORNE NATURALLY OCCURRING ASBESTOS SAMPLING REPORT

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Title: Sampling at Oak Ridge High School for Airborne Naturally Occurring Asbestos, June 2003

Prepared by: Kathleen Gill, Air Pollution Specialist

Approval: The following monitoring report has been reviewed and approved by the Monitoring and Laboratory Division.

Signatures:

Jeffrey F. Cook, Chief
Quality Management Branch
Monitoring and Laboratory Division

11.06.03
date

Kenneth R. Stroud, Chief
Air Quality Surveillance Branch
Monitoring and Laboratory Division

11-06-03
date

William V. Loscutoff, Chief
Monitoring and Laboratory Division

11.6.03
date

II. Introduction

El Dorado Hills is an area of El Dorado County located east of Sacramento (Figure 1) and is known to contain pockets of naturally occurring asbestos (NOA). Asbestos is commonly found in ultramafic rock, including serpentine, and near fault zones. Asbestos is released from rock when it is broken or crushed. It is also released naturally through weathering and erosion. Once released from the rock, the NOA can become airborne. If inhaled, asbestos fibers can penetrate body tissues and remain in the lungs and the tissue lining the lungs and abdominal cavity. The fibers that remain in the body are thought to be responsible for asbestos-related diseases. The illnesses caused by asbestos may not be observed for twenty or more years.

NOA has been identified in the El Dorado Hills area primarily in association with the Bear Mountains Fault Zone, which runs north to south across El Dorado County. Specifically, NOA is exposed in the road cut on the south side of Harvard Way in El Dorado Hills. Oak Ridge High School (ORHS) is located at 1120 Harvard Way and the presence of NOA on campus grounds is well documented.

Ambient airborne asbestos sampling was initially conducted at ORHS by the ARB in 1998 and 1999 due to community concerns regarding NOA in El Dorado County. No airborne asbestos was detected during this sampling. Early in 2002, excavation for the construction of soccer fields on the ORHS campus uncovered NOA bearing rock. NOA management and mitigation measures were implemented to control dust emissions during construction. Excavators piled and graded dirt into two plateaus for the playing fields. Completion of the soccer fields was stopped due to issues regarding availability of irrigation water.

Sampling and testing conducted by a private geotechnical services company under contract to the school, confirmed trace levels of NOA (<1% by volume using U.S. EPA PLM bulk method 600/R93-116) in the fills for the soccer field. Trace levels of NOA were also found in the cut bank exposures for the soccer fields and the parking lot on the northwest side of the school. NOA was identified in soil samples on the school grounds. Long-term NOA control systems were installed, including the paving of a parking area extension on the northwest side of the school and the placement of geotextile mesh on cut slopes.

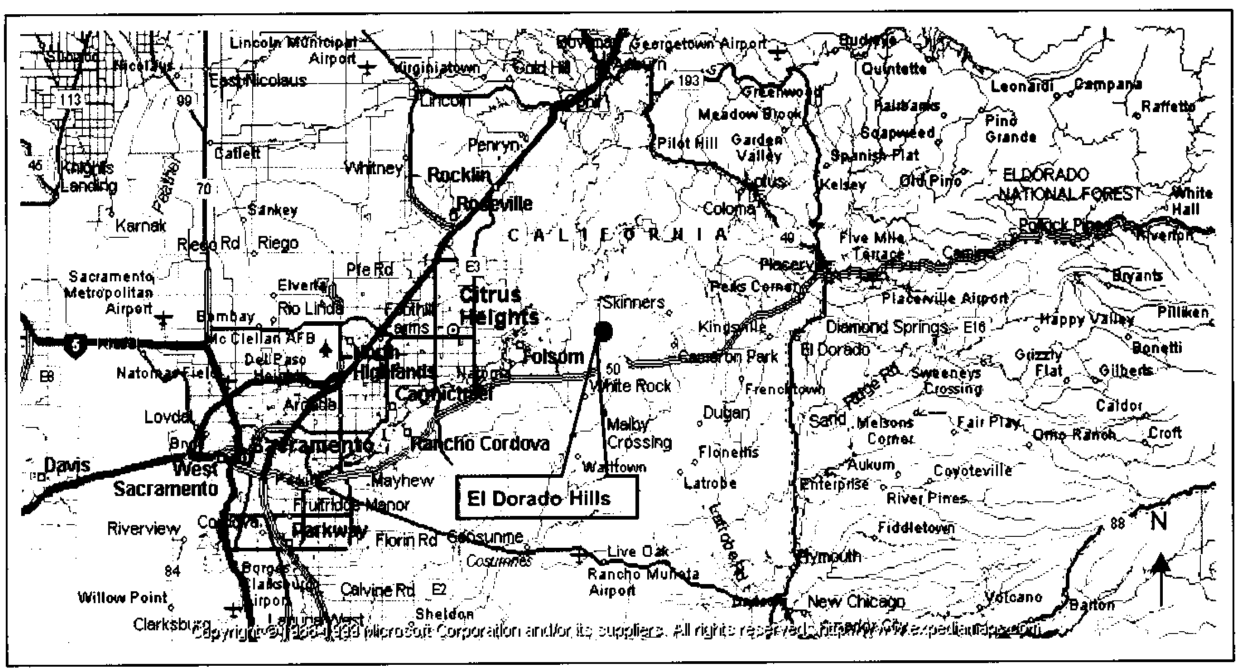
In April of 2003, the El Dorado County Air Quality Management District (EDCAQMD) requested the Air Resources Board's (ARB) Monitoring and Laboratory Division (MLD) perform ambient airborne asbestos monitoring at Oak Ridge High School. This sampling was conducted to assess the nature and extent of asbestos fibers released during mitigation of naturally occurring asbestos (NOA) while completing the school's soccer fields. Mitigation consisted of covering asbestos containing soils and slopes with dirt, grass, concrete, etc., as appropriate for the site, as well as preventing dust emissions by wetting all soils present on the fields and soils brought to the fields. This mitigation was subject to Title 17, California Code of Regulations, section 93105, Asbestos Airborne Toxic Control Measure (ATCM) for Construction, Grading, Quarrying,

and Surface Mining Operations. The monitoring was conducted by the ARB in conjunction with EDCAQMD and in cooperation with the El Dorado Union High School District. Asbestos TEM Laboratories, Inc., analyzed samples using transmission electron microscopy (TEM) following the AHERA method procedures with ARB specified modifications.[1,2]

The project involved air sampling at the perimeter of the soccer fields as well as selected nearby locations on and off school grounds. Monitoring included 10-hour duration samples during the daily mitigation process that disturbed original surfaces and slopes that had the potential for releasing airborne asbestos as well as 23-hour duration samples at receptor sites near the soccer fields. Side-by-side (collocated) samples were taken at two sites representing the two sampling timeframes. Sampling occurred before, during and after mitigation work using a fenceline and receptor monitoring approach.

Fenceline monitoring was conducted at the perimeter of the soccer fields to assess potential NOA emissions from the site during construction activities. Receptor monitoring was conducted in areas near residences to determine possible drift off-site of airborne NOA. They also served as background sites when no activity was taking place. See Figure 2 for a view of the Oak Ridge High School Campus and Figure 5 for sampler placement.

Figure 1 El Dorado Hills and Surrounding Area



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[1] Asbestos TEM Laboratories, Inc., 1409 Fifth Street, Berkeley, CA 94710

[2] AHERA – 40CFR-Chapter 1-Part 763-Appendix A to Subpart E, March 26, 2002

During the ARB's sampling, the school district contracted with an independent sampling firm to conduct additional airborne asbestos monitoring on the school grounds. This monitoring was conducted while mitigating designated "areas of concern." Areas of concern were identified by the Department of Toxic Substances Control (DTSC) during an inspection of the campus prior to the start of the soccer field mitigation. They had visible serpentinite rock, ultramafic rock, or visible fibers of NOA and were located in pedestrian areas of the school campus such as planter boxes adjacent to buildings, unpaved areas used for parking, exposed dirt footpaths, etc. [3]

Ambient air samples collected by ARB staff during soccer field construction contained asbestos concentrations ranging from below the detection limit (0.0005 structures per cubic centimeter, s/cc) up to 0.0039 s/cc of sampled air. Most of the samples reported detectable NOA, although the average concentration for all samples was 0.0008 s/cc. This report presents the results and findings of the sampling.

III. OAK RIDGE HIGH SCHOOL SOCCER FIELD CONSTRUCTION AND NOA MITIGATION

ORHS implemented dust control measures at the unfinished soccer fields per the ATCM while mitigating the potential for future exposure to NOA. The NOA mitigation included total encapsulation of the surface of the two soccer fields with a polypropylene geotextile fabric followed by placement of approximately twenty-four (24) inches of clean fill material on top of the fabric layer. All fill dirt and aggregates used on the school campus and soccer fields were tested under the direction of the Department of Toxic Substance Control (DTSC), and were certified to be asbestos-free (<0.0001% asbestos by weight analyzed by TEM and not detected, ND, by CARB 435 point counting). A grass playing surface was placed on top of the encapsulated soils.

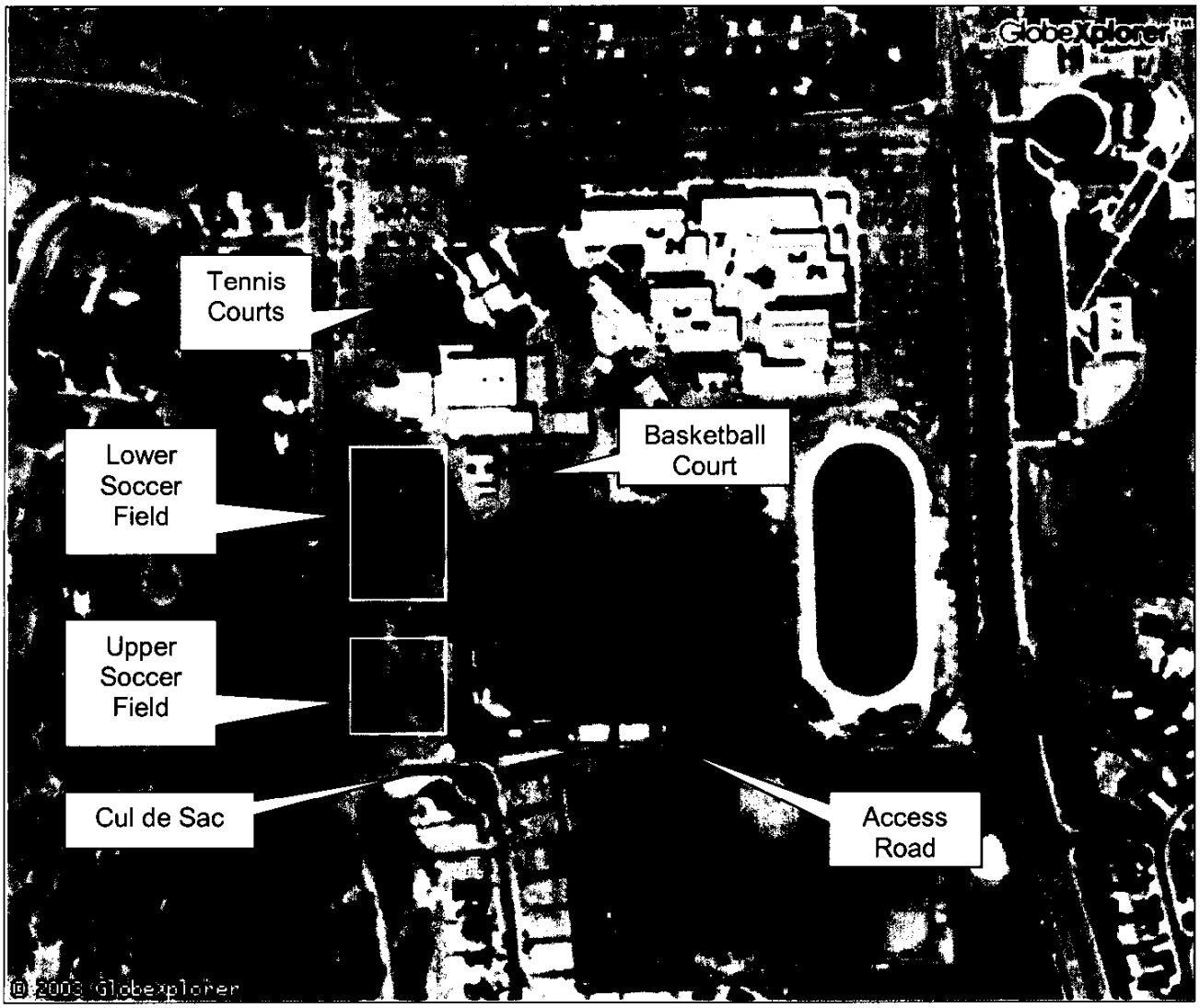
The soccer fields are elevated with respect to the main school campus area, the adjacent baseball field, and the basketball courts. The soccer fields themselves are at two different elevations as shown in Figure 3. The lower soccer field east side slope is approximately 23°, 13 feet above grade and the upper soccer field east side slope is approximately 26° and 27 feet above grade. The lower soccer field dimensions are approximately 220 feet wide by 360 feet long. The upper field is approximately 140 feet wide by 250 feet long. The 26° slope between the two is 16 feet above grade. There is a residential area along the western side of the lower soccer field. There are several homes adjacent to the school property.

The first step in the encapsulation work was compressing the existing weed cover on the fields. Due to the late spring rains, some weeds grew to a height of two feet or more on the fields. The vegetation provided some natural dust mitigation of the fields, but hindered placement of the geotextile fabric. Weed compression and fabric placement at the soccer fields began on June 17, 2003. The weeds were wetted and mechanically compressed with a motor driven roller. The geotextile fabric blanket was manually rolled over the entire surface of both soccer fields and pinned in place. This isolated the

[3] Department of Toxics Substance Control, 880 Cal Central Dr., Sacramento, California 95826

underlying NOA containing soils from the fill applied above. Air monitoring began prior to construction (June 16, 2003,) to obtain background ambient asbestos concentration data in the absence of activity. *Note that throughout this report, the term "background" refers only to sampling performed by ARB at ORHS during days of non-activity on the soccer fields and cannot be extrapolated to mean background conditions for El Dorado County or elsewhere.* Subsequent air monitoring was conducted when work was performed on the fields, i.e., only on weekdays.

Figure 2 Oak Ridge High School Campus



Note: Photograph was taken prior to soccer field excavation.

Access to the lower soccer field was by way of an aggregate covered road from the parking lot to the northwest corner of the field. Access to the upper field was by way of a decomposed granite road traversing the southern end of the school campus up an incline to the soccer field. Part of the upper field access road was covered with four inches of aggregate road base (AB) before hauling began to prevent possible fugitive dust emissions while trucks brought fill dirt to the upper field. Decontamination pads were built on the soccer fields at the end of each access road as an area to clean the trucks as they left the fields to prevent trackout.

During the construction and mitigation, the school was obligated to follow the Asbestos Airborne Toxic Control Measure (ATCM) for Construction, Grading, Quarrying, and Surface Mining Operations. Throughout the project, per the ATCM, water was applied to prevent visible dust emissions from crossing the property line. Vehicle speed was kept at less than 15 miles per hour, vehicles and equipment were washed prior to moving onto a paved public road, and visible trackout was cleaned from the paved parking lot at the base of the soccer field each day.

While the weeds were being rolled and the fabric covering was placed on the fields, holes were dug and fenceposts were installed around both fields. Two-foot tall cardboard collars were placed around the fenceposts and filled with cement for footings to place the posts at grade level after fill was added. Twenty-four inches of clean fill dirt was then placed on each field and covered the footings. On July 3rd, activity was suspended and both fields were thoroughly wetted to contain dust emissions over the holiday weekend. Work resumed on July 7th.

After the fill dirt was applied, the western slope (nearest the residences) and the southwest corner slope of the lower field were covered with a shotcrete, a sprayed form of concrete intended to reduce erosion of the cut banks. The remaining slopes were covered with soil. Fencing was erected around each field.

The final phase of construction at the soccer fields included installing an irrigation system and covering the slopes and surfaces with mulch and grass. Irrigation systems were installed within the new fill dirt without intruding into the original NOA -containing fill or slopes.

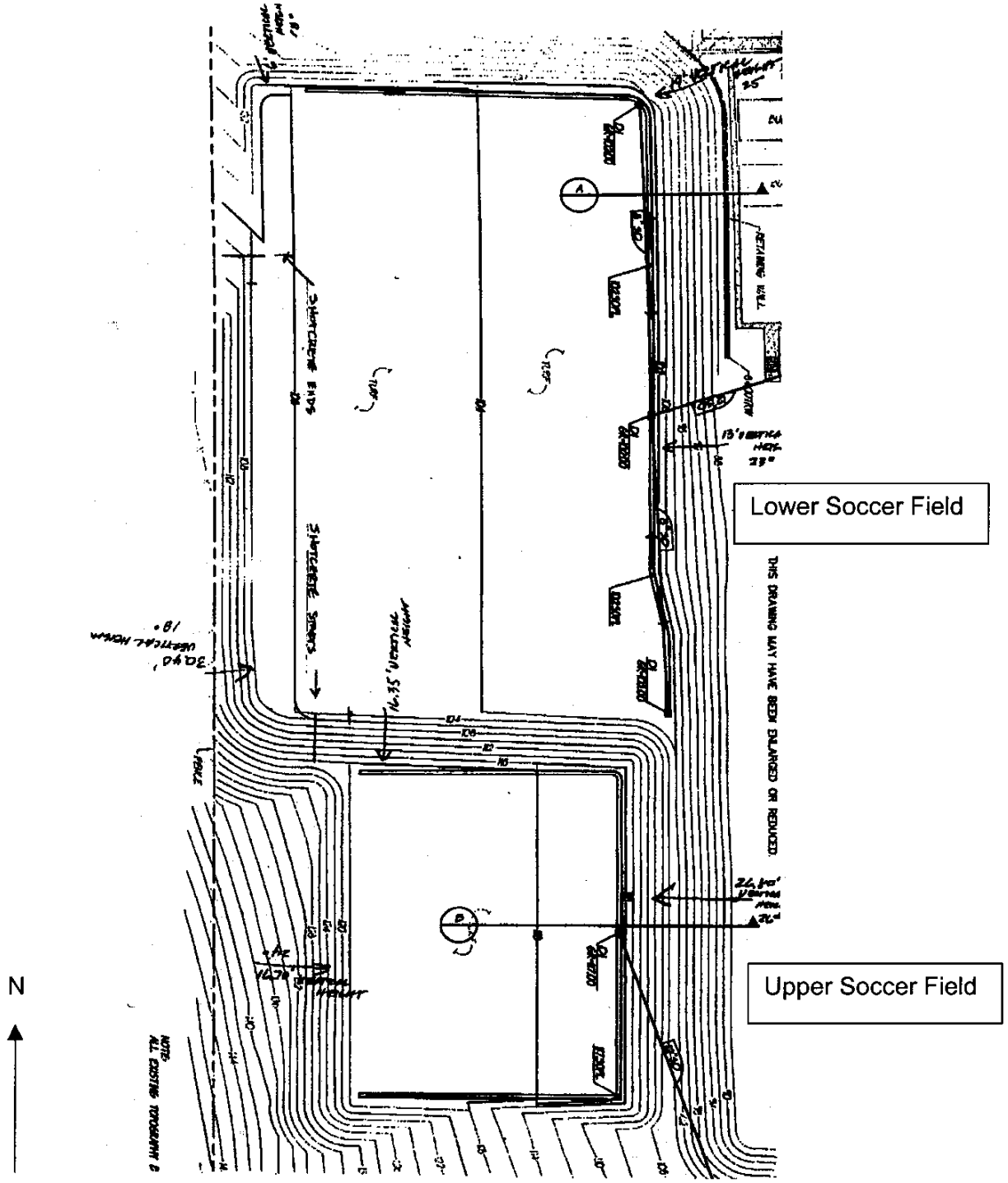
Oversight of the construction and mitigation activities was performed by MACTEC, an engineering, environmental and remedial construction firm, under contract to the school. Table 1 is a summary of daily activities at each soccer field. Information was provided by MACTEC personnel, and from observations made by ARB field staff.

IV. SAMPLING

Complete details of the monitoring requirements can be found in the monitoring protocol in Attachment 1. Operation of the fenceline monitors occurred one hour before the construction/mitigation work started each day until one hour after work stopped for the

day (6:00 a.m. until 4:00 p.m.) Receptor monitors operated for 23 hours with the same stop time as the fenceline monitors, from 5:00 p.m. until 4:00 p.m. the following day.

Figure 3 Soccer Field Elevations



Because mitigation work extended to the edge of each of the fields, some samplers were placed on the slopes at the perimeter of each field. The emphasis was to place sample inlets at normal breathing height--approximately five feet above the level surface of the soccer fields--near the edges of the fields. Table 2 summarizes the locations of the sampling equipment and heights of filter inlets above the ground.

Table 1 Daily Field Construction Activities

Sampling Date	Lower Field Activity	Upper Field Activity
6/16 – 6/17/03	No activity	No activity
6/17 – 6/18/03	Constructed decontamination pad, wet weeds, rolled weeds with mechanical roller	No activity
6/18 – 6/19/03	Wet and rolled weeds, dug post holes	No activity
6/19 – 6/20/03	Wet and completed rolling weeds, continued digging post holes, began fence post installation, fabric placement	Constructed decontamination pad, placed 4 inches of road base on access road
6/22 – 6/23/03	Continued placing and pinning filter fabric (90% complete), completed digging post holes, installed fence posts, cemented fence posts	Wet and completed rolling weeds
6/23 – 6/24/03	Completed fabric placement and pinning, poured 2 feet of cement for footings around fence posts, applied 25 truckloads of fill dirt (6"-8" fill dirt on entire field)	Completed fabric placement and pinning, completed digging post holes
6/24 – 6/25/03	Applied 44 truckloads of fill dirt, spread to 12" on half of field	Installed fence posts and cemented in place
6/25 – 6/26/03	Applied 44 truckloads of fill dirt, spread to 12" on 2/3 of field	2 foot cement footings poured around fence posts, dug post holes near access road
6/26 – 6/27/03	Applied 44 truckloads of fill dirt, spread to 12" on ¾ of field	Dug fence post holes
6/29 – 6/30/03	Applied 44 truckloads of fill dirt, spread to 12" on entire field, pinned mesh on west slope in preparation of shotcrete application	No activity
6/30 – 7/1/03	Cut weeds on west slope	Dug trench and basin for decon pit, applied 40 truckloads of fill dirt, spread to 12" on ½ of field
7/1 – 7/2/03	Covered decontamination pad with fill dirt	Applied 24 truckloads of fill dirt, spread to 12" on entire field
7/2 – 7/3/03	Wet field for holiday weekend	Wet field for holiday weekend, applied additional fill dirt
7/6 – 7/7/03	Began shotcrete application on west slope	Applied fill dirt to 24" on ½ of field
7/7 – 7/8/03	Shotcrete applied to west slope, applied fill dirt to 24" on ½ field	Applied fill dirt to 24" on entire field – mitigation completed
7/8 – 7/9/03	Shotcrete application on west slope completed, applied fill dirt to 24" on entire field – mitigation completed	No activity
7/9 – 7/10/03	No activity	No activity

Table 2 Sampling Sites

Site	Sample ID	Latitude	Longitude	Filter Inlet Height Above Ground (inches)
Upper Soccer Field				
Upper West B - 10hr	WB-8	N 38° 40.708'	W 121° 04.365'	60
Upper North (Lower South) - 10hr[4]	UNLS-8	N 38° 40.734'	W 121° 04.348'	50
Upper North (Lower South) - 23hr[5]	UNLS-23	N 38° 40.735'	W 121° 04.351'	50
Upper East B - 10hr	EB-8	N 38° 40.718'	W 121° 04.332'	45
Upper South - 10hr	US-8	N 38° 40.695'	W 121° 04.348'	60
Upper South - 23hr	US-23	N 38° 40.695'	W 121° 04.346'	60
Upper Access Road (1) - 10hr	R1-8	N 38° 40.702'	W 121° 04.284'	54
Upper Access Road (2) - 10hr	R2-8	N 38° 40.690'	W 121° 04.293'	58
Lower Soccer Field				
Lower West A - 23hr	WA-23[6]	N 38° 40.770'	W 121° 04.381'	55
Lower North - 10hr	LN-8	N 38° 40.796'	W 121° 04.353'	48
Lower North - 23hr	LN-23	N 38° 40.796'	W 121° 04.354'	48
Lower East A - 10hr	EA-8	N 38° 40.668'	W 121° 04.329'	54
Lower East A - 10hr collocated	EAC-8	N 38° 40.767'	W 121° 04.329'	54
Lower South (Upper North) - 10hr[4]	UNLS-8	N 38° 40.735'	W 121° 04.347'	50
Lower South (Upper North) - 23hr[5]	UNLS-23	N 38° 40.736'	W 121° 04.349'	50
Receptor Sites				
Cul-de-sac East - 23hr collocated	CdS E	N 38° 40.683'	W 121° 04.341'	60
Cul-de-sac West - 23hr	CdS W	N 38° 40.683'	W 121° 04.342'	60
Basketball Court - 23hr	BC-23	N 38° 40.786'	W 121° 04.293'	54
Tennis Court - 23hr	TC-23	N 38° 40.851'	W 121° 04.359'	60

A. Sampling Equipment and Operation

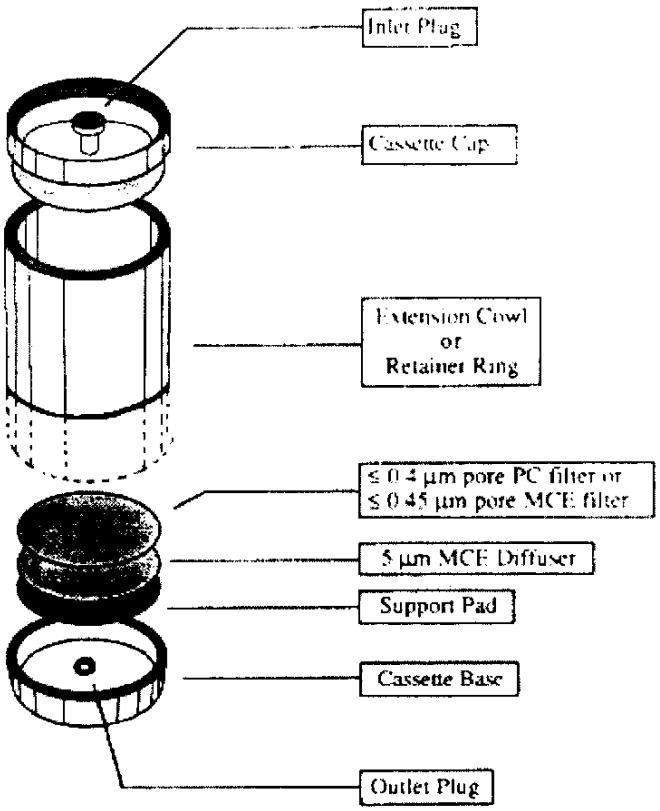
Sampling equipment used for this project consisted of seventeen (17) custom asbestos samplers and two battery-operated Met One meteorological stations. The airborne asbestos samplers were made by MLD's Air Quality Surveillance Branch (AQSB) staff and consist of a battery-operated pump and a sample filter contained in a cowling, referred to as a filter cassette. Each sampler is capable of 24 hours of continuous operation.

Samples were collected in cassettes that contianed a 25 millimeter (mm) diameter filter made of mixed cellulose ester (MCE) material. The filter has a pore size of less than or equal to 0.45μm. It is used with a 5μm pore size support pad. The filter collected particles, fibers, and dust in the air as air was

[4] Upper North and Lower South –10hr is a single sampler.
[5] Upper North and Lower South –23hr is a single sampler.
[6] Because of its proximity to a residence, this fenceline monitor was operated for 23 hours, as were the receptor monitors, instead of 10 hours.

drawn through it. Flow checks were then conducted to ensure correct flow rates during sampler operation.

Figure 4 Asbestos Filter Cassette



Each sampler was operated at a flow rate of approximately eight standard liters per minute (slpm) during each sampling run. An eight slpm flow rate ensured that enough air volume was drawn through the sampler during each 23-hour period (11.0 m^3) that asbestos fibers would be detected, if present, at the detection limit of 0.0005 structures per cubic centimeter (s/cc). Ten-hour duration samples were collected at the same flow rate as the 23-hour duration samples. Flow rate was calculated as an average of the initial and end flow rate readings and recorded on the COC/field record forms. Samples in which there was more than a 25 percent difference from initial flow check to end flow check were invalidated. The average flow rate was used to calculate the sample volume.

The samplers were configured to collect total suspended particulate. They were not equipped with any size selective inlet, impactor, or cyclone.

B. Meteorological Data

Two portable meteorological (met) stations manufactured by Met One Instruments were used to record hourly average wind speed and wind direction data as well as relative humidity and ambient temperature. One met station was placed on the upper soccer field at the southwest corner and the other was placed on the basketball court near the location of the asbestos sampler. Refer to the triangle shapes on Figure 5. Data from the met stations were downloaded to a laptop computer to generate wind roses. Tables 2 and 3 summarize the daily meteorological conditions. Complete detailed meteorological data and wind roses are contained in Attachment 2. Wind roses are also displayed on the daily concentration diagrams in Attachment 3.

Due to the local topography, wind patterns changed throughout each day and between days as indicated on the attached wind roses. The prevailing wind in this area during this study was from the south-southeast. This placed the upper field met station upwind from the fields. This met station exhibited only 2.2 percent calm winds on June 24th. All other days, at both met stations, had zero percent calm winds. Maximum wind speed during the monitoring was on June 24th at 8.1 miles per hour recorded at the basketball court met station and 9.9 miles per hour recorded at the upper field met station.

Table 3 Upper Field Met Station Data

Sampling Date	Prevailing Wind Direction	10 Hour Average Wind Speed (mph)	24 Hour Average Wind Speed (mph)	Highest Wind (mph)	Percent Calm Wind
6/17/03	SSE	4.66	4.31	6.5	0
6/18/03	SSE	6.77	6.17	8.9	0
6/19/03	SSE	5.12	4.15	6.9	0
6/20/03	SSE	5.10	4.78	6.5	0
6/23/03	SSE	4.44	3.67	7.6	0
6/24/03	N	6.84	5.01	9.9	2.2
6/25/03	N	3.66	NA	6.7	0
6/26/03	N/S	3.70	2.88	6.0	0
6/27/03	SSE	4.18	3.15	7.1	0
6/30/03	SSE	4.71	3.98	6.4	0
7/1/03	SW	4.31	3.41	6.9	0
7/2/03	SSE	3.63	3.21	5.0	0
7/3/03	SSE	4.67	3.66	7.1	0
7/7/03	SSE	6.27	5.86	7.5	0
7/8/03	N	4.20	3.91	7.1	0
7/9/03	N	4.00	3.04	6.5	0
7/10/03	SE	3.78	NA	6.4	0

NA = not all data recorded

Table 4 Basketball Court Met Station Data

Sampling Date	Prevailing Wind Direction	10 Hour Average Wind Speed (mph)	24 Hour Average Wind Speed (mph)	Highest Wind (mph)	Percent Calm Wind
6/17/03	SSE	2.29	2.03	3.1	0
6/18/03	SSE	2.99	2.70	4.2	0
6/19/03	SSE	2.66	2.23	3.7	0
6/20/03	SSE	2.69	2.67	4.7	0
6/23/03	SSE	3.03	2.49	5.7	0
6/24/03	NW	5.23	3.61	8.1	0
6/25/03	NNW	2.56	NA	4.9	0
6/26/03	N/S	2.47	2.09	4.6	0
6/27/03	NW	2.99	2.18	5.0	0
6/30/03	SSE	2.89	2.52	4.1	0
7/1/03	SSE	2.55	NA	3.9	0
7/2/03	SE	2.56	2.01	4.0	0
7/3/03	SSE	3.03	2.18	4.7	0
7/7/03	SSE	3.52	3.26	4.9	0
7/8/03	SSE	3.03	2.73	5.0	0
7/9/03	S	3.00	2.14	4.8	0
7/10/03	S	2.83	2.20	4.7	0

NA = not all data recorded

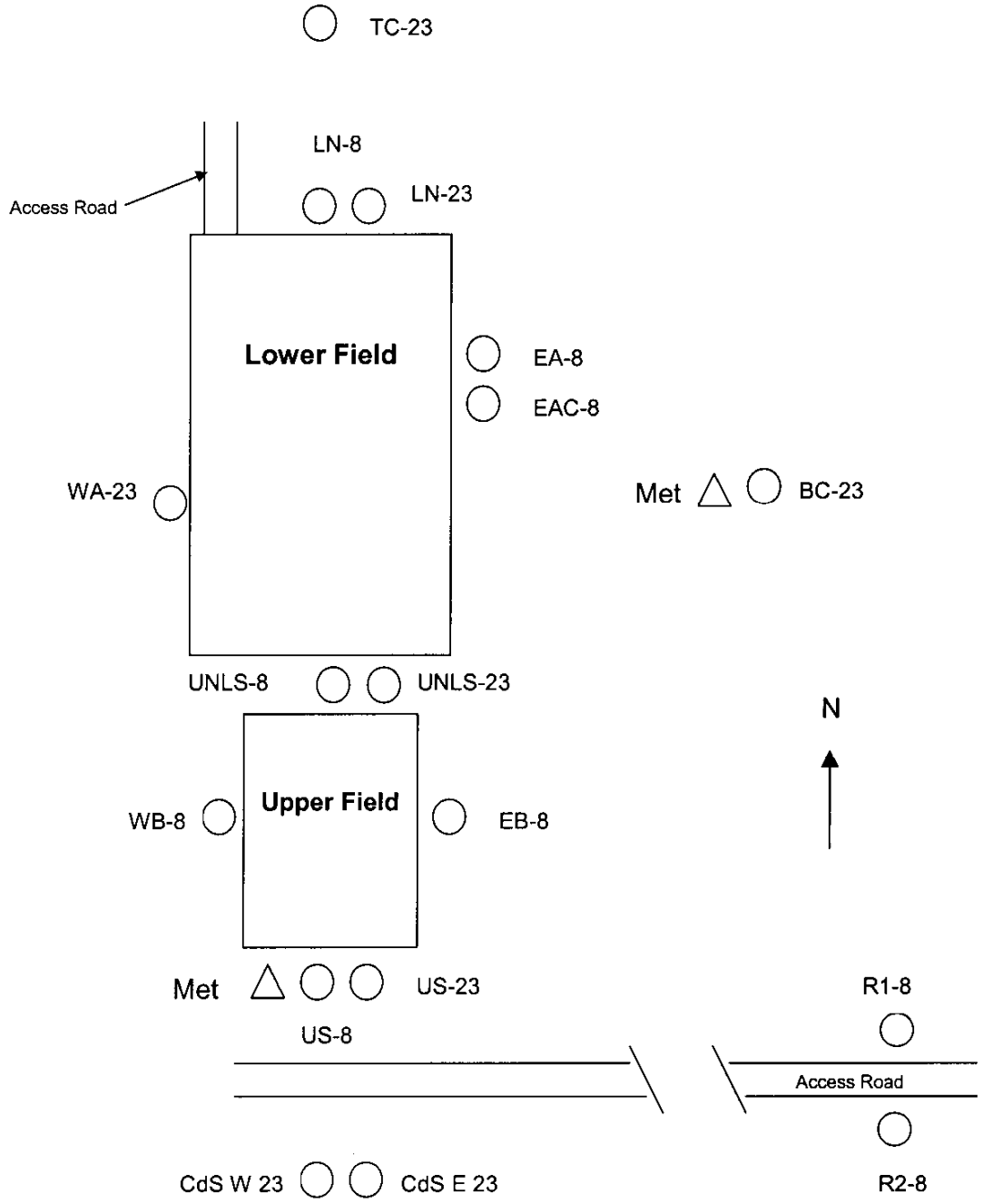
C. Sampling Sites

Figure 5 shows the location of the seventeen ambient air samplers that were in place each day during mitigation. Table 2 details the exact placement of samplers and the heights of the filter inlets.

The two samplers labeled Upper North/Lower South, 10-hour and 23-hour, were placed on the slope between the upper and lower fields. Initial placement was relative to the lower field where work was performed first. When work commenced on the upper field, on June 30th, the samplers were elevated on the slope such that the filter inlets were at breathing height relative to the upper field.

Figure 5 Sampler Placement

(Refer to Table 2 for site names.)



V. Analytical Procedures

ARB's Asbestos ATCM requires that analysis of all asbestos air samples follow 40CFR, Part 763, Appendix A to Subpart E. 40CFR, Part 763, Asbestos Containing Materials in Schools, referred to as the Asbestos Hazard Emergency Response Act (AHERA), details specific requirements with respect to analytical sensitivity, identification of fibers, aspect ratio of asbestos fibers counted, etc.

A. AHERA

The ATCM lists the following exceptions to the standard AHERA method when analyzing filters used for airborne asbestos collection: 1) The analytical sensitivity shall be 0.001 structures per cubic centimeter of sampled air (s/cc), rather than 0.005 s/cc and, 2) All asbestos structures with an aspect ratio greater than three to one (3:1) shall be counted irrespective of length. As written, AHERA requires an aspect ratio equal to or greater than five to one (5:1). An aspect ratio of greater than 3:1 means that shorter fibers would be included in the fiber count that would not be included using a 5:1 ratio.

All analyses of asbestos samples were conducted using transmission electron microscopy (TEM). TEM analysis, as defined in AHERA, requires that asbestiform fibers first be identified using Selected Area Electron Diffraction (SAED). Then, in the case of amphiboles, identification is confirmed using Energy Dispersive X-Ray Analysis (EDXA). EDXA also provides information on the specific type of amphibole. If a fiber does not produce a distinct SAED pattern, no EDXA is required. However, to be classified as an amphibole under AHERA, a fiber must be identified using SAED and EDXA.

B. Analytical Sensitivity

The laboratory analytical results are reported in structures per cubic centimeter (s/cc) for air samples. The analyst can detect individual fibers, bundles, clusters, and matrices of fibers. Each asbestos fiber was sized, classified as greater than or less than 5μm, and identified by the laboratory as to its type of asbestos. As defined in AHERA, all fibers, bundles, clusters, and matrices of fibers were classified and reported as structures. The analysis met the analytical sensitivity requirement of the AHERA TEM method and the ATCM for air samples.

Minimum detection limits are calculated based on the volume of air sampled and therefore, may vary among samples. When the goal of sampling a minimum of 11,000 liters of air is achieved, the minimum detection limit is 0.0005 s/cc. Smaller volumes of air result in higher detection limits; however counting additional grids on the filter can offset this effect. All samples for this project required a detection limit of 0.0005 s/cc, which was achieved either by volume sampled or number of grids counted. The additional grid analysis provided consistent detection limits and allows for comparability between short duration

(10-hour) and long duration (23-hour) samples. The 0.0005 s/cc sensitivity also allows for consistency between previous sampling events conducted in El Dorado County and other locations in the state monitored by the ARB for NOA.

VI. DATA QUALITY AND MEASUREMENT OBJECTIVES

The overall quality assurance objective for this project was to produce well-documented data of known quality. Quality assurance objectives are composed of quality control and quality assessment and are evaluated in terms of:

- accuracy - the degree of agreement with accepted reference or "true" values,
- precision -the degree of mutual agreement among individual measurements taken under the same prescribed conditions,
- completeness - the amount of valid data recovered compared with expectations,
- representativeness - an expression of the degree to which measurement results relate to key characteristics or conditions,
- comparability - an expression of the degree to which one data set can be related to another, and
- minimum detection limit - the lowest concentration at which an analyte can be reliably quantitated.

A. Sampling Strategy

The sampling strategy for the ORHS soccer fields was to operate two networks of samplers. One network consisted of nine samplers operating during times of construction/mitigation activity on the soccer fields collecting 10-hour duration samples. These samplers were placed at the fenceline of the soccer fields and on the upper field access road. The second network consisted of eight samplers operating for 23-hours placed at receptor sites where people lived and students played. Both networks had the following sampling objectives:

- Conduct two days of background sampling, one before start of and one after completion of construction/mitigation activities, with background being defined as no construction or mitigation activity taking place on the soccer fields,
- Operate all samplers for 23-hour duration during background sampling, do not operate collocated samplers during background sampling,
- Operate all samplers coincidentally with all stop times the same each day between networks and start times the same each day within each network,
- Operate two collocated samplers, one at a receptor site and one at a fenceline site in order to represent each temporal network ,
- Collect samples on each day there was activity on the soccer fields, and
- Record daily construction/mitigation activity to evaluate impact on concentration results.

The following table indicates which samplers were in operation on any

given day. The 10-hour fenceline samplers operated from one hour before construction/mitigation activities began until one hour after activities stopped for the day (6:00 a.m. to 4:00 p.m.). The 23-hour samplers operated overnight and on the following day (5:00 p.m. until 4:00 p.m.) located at receptor sites (tennis court, basketball court, cul-de-sac home). In Table 5, "All" refers to upper field samplers, lower field samplers, access road samplers, receptor samplers and collocated samplers operating for 10 or 23 hours. During background sampling, fenceline and receptor samplers operated for 23 hours. Figure 6 is a field-sampling timeline prepared for use by the operators.

Table 5 Sampler Operating Days

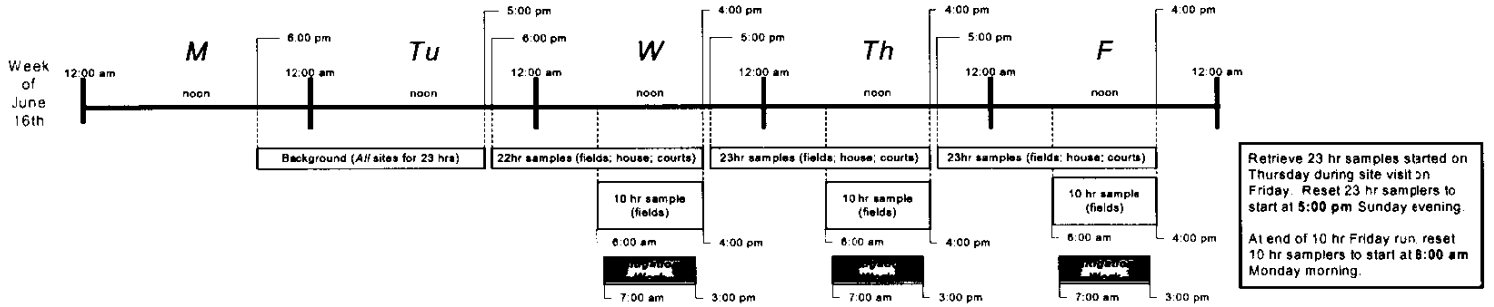
Sampling Date	Sampling Scheme
6/16 – 6/17/03	Background – all but collocated for 23 hours
6/17 – 6/18/03	No road, no upper field, 10 and 23 hour
6/18 – 6/19/03	No road, no upper field, 10 and 23 hour
6/19 – 6/20/03	No road, 10 and 23 hour
6/22 – 6/23/03	No road, 10 and 23 hour
6/23 – 6/24/03	All, 10 and 23 hour
6/24 – 6/25/03	All, 10 and 23 hour
6/25 – 6/26/03	All, 10 and 23 hour
6/26 – 6/27/03	All, 10 and 23 hour
6/29 – 6/30/03	All, 10 and 23 hour
6/30 – 7/1/03	All, 10 and 23 hour
7/1 – 7/2/03	All, 10 and 23 hour
7/2 – 7/3/03	All, 10 and 23 hour
7/6 – 7/7/03	All, 10 and 23 hour
7/7 – 7/8/03	All, 10 and 23 hour
7/8 – 7/9/03	All, 10 and 23 hour
7/9 – 7/10/03	Background - all but collocated for 23 hours

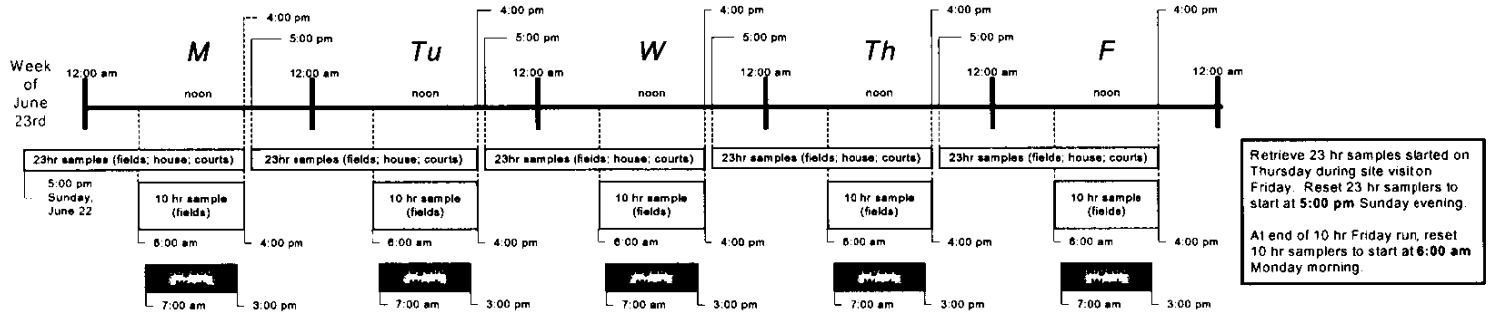
B. Coincident Sampling

Coincident samples are defined as samples collected at the same start and end time on the same day. Sample start and end times were to be within one hour of each coincident sample to have met the coincident sampling objective. The samples within each network were coincident with each other and the stop times for all samples were consistent between networks. Consistent start times between all of the receptor monitors were achieved by operating samplers for 23 hours instead of 24 hours. The one hour window gave the field operators time to exchange filters at all sites and begin sampling coincidentally while adhering to the 24 $\pm$ 1 hour criteria defined for particulate monitoring. 100% of the valid 10-hour samples were coincident and 96% of the valid 23-hour samples were coincident. Both networks met the goal of 80% coincidence.

Figure 6 Field Sampling Timeline

Oak Ridge High School Asbestos Sampling
Sampling schedule for 6/16/03 - 6/27/03
Estimated duration of soccer field mitigation monitoring: 6/16/03 - 7/11/03

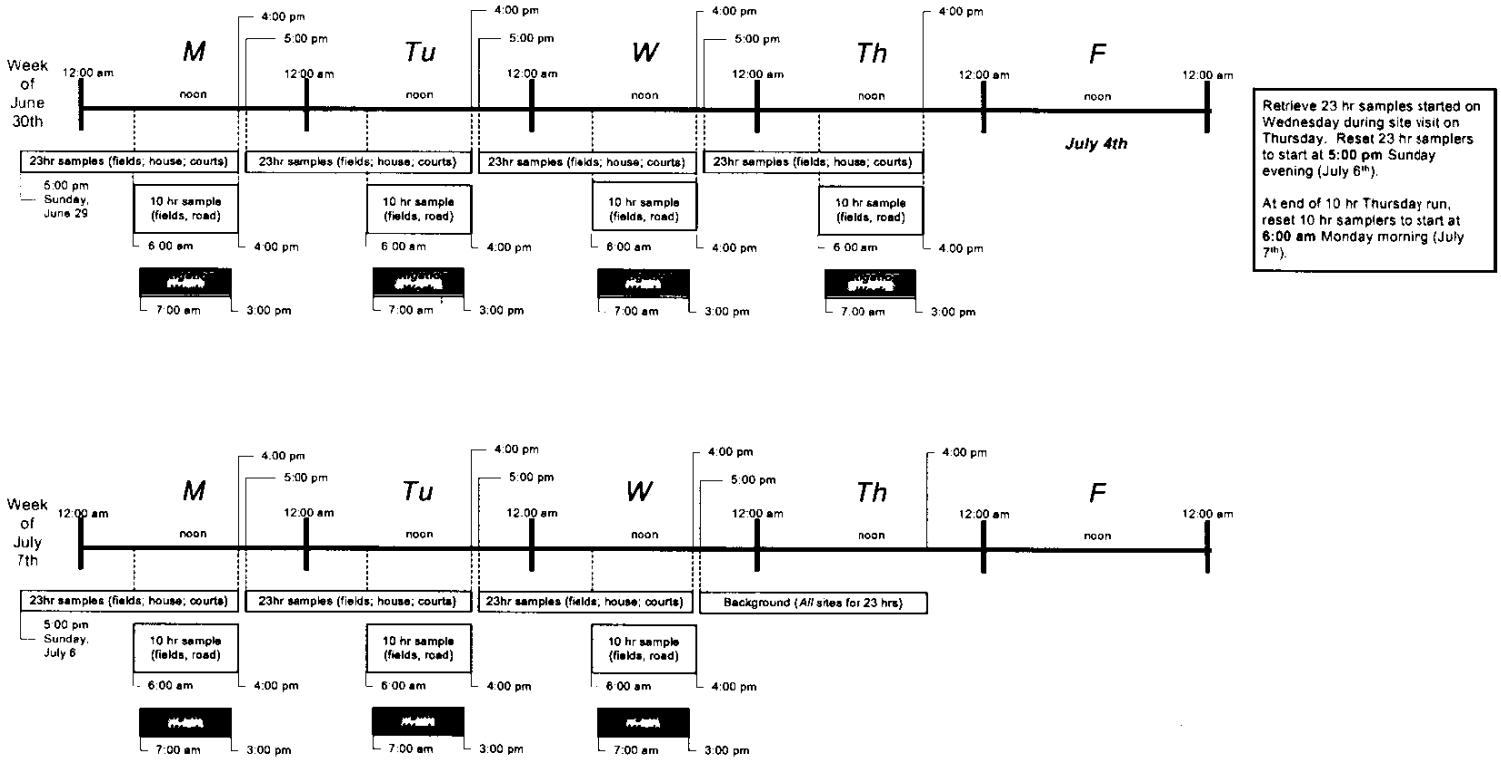




Fields = Upper/Lower Soccer Fields
House = House on Cul-de-Sac
Courts = Basketball Court & Tennis Court

Figure 6 (cont.) Field Sampling Timeline

Oak Ridge High School Asbestos Sampling
Sampling schedule for 6/30/03 - 7/11/03
Estimated duration of soccer field mitigation monitoring: 6/16/03 - 7/11/03



Fields = Upper/Lower Soccer Fields
House = House on Cul-de-Sac
Courts = Basketball Court & Tennis Court
Road = Unpaved access road on south side of fields

C. Completeness

Completeness is an assessment of the amount of valid data obtained compared to the amount of data expected. Percent completeness was calculated by dividing the number of samples with acceptable data by the total number of samples collected and multiplying the result by 100.

Valid samples are defined as samples that meet all criteria associated with sampler calibration, sample collection and review, and laboratory analysis outlined in this protocol and applicable sampling and laboratory standard operating procedures (SOPs). Samples that did not meet validation objective were considered invalid and any associated concentrations were not reported. Because of the nature of this special study and the mitigation schedule, corrective action in the way of make-up samples was not possible.

The goal for this project was to obtain greater than 75 percent of the expected number of air samples on any day, as well as 100% of coincident collocated pairs. Overall completeness was calculated to be 84%. The goal to obtain at least 75% of the expected samples for each monitoring day was met on 14 of 17 days. As shown in Table 6 below, there were three sampling days with less than 75% completeness. Completeness for the receptor network was 86% and 82% for the fenceline network. Completeness for collocated pairs was 83%. (94% for the receptor network and 64% for the fenceline network.) A pair of collocated samples was collected at the receptor site on the first day of background sampling.

Table 6 Completeness

Sampling Date	Expected # Samples	# Valid Samples Collected	Percent Complete	Expected # Collocated Pairs	# Valid Collocated Sample Pairs	Percent Complete (Collocated)
6/16 – 6/17/03	12	12	100	0	1	NA
6/17 – 6/18/03	12	12	100	1	1	100
6/18 – 6/19/03	11	11	100	1	1	100
6/19 – 6/20/03	15	15	100	2	2	100
6/22 – 6/23/03	17	13	76	2	2	100
6/23 – 6/24/03	17	16	94	2	2	100
6/24 – 6/25/03	17	16	94	2	2	100
6/25 – 6/26/03	17	8	47	2	1	50
6/26 – 6/27/03	17	16	94	2	2	100
6/29 – 6/30/03	17	9	53	2	1	50
6/30 – 7/1/03	17	13	76	2	1	50
7/1 – 7/2/03	17	12	71	2	2	100
7/2 – 7/3/03	17	16	94	2	1	50
7/6 – 7/7/03	17	15	88	2	1	50
7/7 – 7/8/03	17	17	100	2	2	100
7/8 – 7/9/03	17	13	76	2	2	100
7/9 – 7/10/03	12	10	83	0	0	NA
TOTAL	**266**	**224**	**84**	**28**	**24**	**83**

D. Spatial and Temporal Representativeness

Spatial and temporal representativeness was achieved by having two monitoring networks. The 10-hour fenceline network assesses impacts from the daily mitigation/construction activities. The 23-hour receptor network reflects the impact of NOA on locations frequented by the students and nearby residents. Figure 7 shows the comparison of asbestos concentrations for the 10-hour duration versus 23-hour duration samples collected at the same sites. As expected, most of the 10-hour duration sample concentrations were somewhat higher than the 23-hour duration sample concentrations. The monitors situated on the slope between the two fields (UNLS) had the most cases of 23-hour concentrations higher than the 10-hour concentrations.

E. Precision

Precision is defined as the degree of mutual agreement among individual measurements made under prescribed conditions. Precision checks for manual methods are obtained by operating collocated samplers at selected sites. For each pair of collocated samplers, the primary sampler was designated as the sampler that was used to report air quality for the site, the other sampler was designated as the duplicate sampler.

Collocated monitors were placed at the fenceline site East A and at receptor site Cul de Sac East. Two filter cassettes were mounted to a single tripod situated approximately six inches apart. Each cassette had its own pump and power supply. Site East A (EA) and Cul de Sac West (CdS W) were designated as the primary samplers and East A Collocated (EAC) and Cul de Sac East (CdS E) were the duplicates at each collocated site.

Although the precision reflects the entire measurement process, both the sample collection and analytical techniques, sample collection precision cannot be measured independent of the analytical precision. Asbestos analytical precision is based on the 95% confidence interval of a Poisson distribution. The TEM analytical technique relies on the experience and expertise of the analyst. Various checks are routinely made on the accuracy of the analyst and to confirm analytical precision. These checks include having the analyst rescan the sample looking at the same grid openings as the original analysis or having a second analyst examine the samples. The second analyst will analyze either 1) the same grid openings as the original analysis, 2) a new area of the original sample preparation, or 3) a new sample preparation. If results are not within the 95% confidence interval, appropriate corrective actions, including retraining, are implemented.

When the analytical precision criteria is applied to the collocated results, all were within the 95% confidence interval as shown in Tables 7 and 8. The 95% criteria can be found in Attachment 5 with the quality control summary.

Table 7 Collocated Results – 10 Hour Fenceline Site

Sampling Date (start - end)	Sample Log#	Sampling Location	Number of Fibers Detected	Within 95% Confidence
6/20	51	EA-8	ND	YES
6/20	52	EAC-8	2	
6/23	71	EA-8	3	YES
6/23	72	EAC-8	2	
6/24	93	EA-8	ND	YES
6/24	94	EAC-8	ND	
6/25	113	EAC-8	3	YES
6/25	114	EA-8	1	
6/26	132	EAC-8	Invalid	NA
6/26	133	EA-8	invalid	
6/27	151	EAC-8	2	YES
6/27	152	EA-8	3	
6/30	169	EAC-8	ND	NA
6/30	170	EA-8	invalid	
7/1	190	EAC-8	Invalid	NA
7/1	191	EA-8	invalid	
7/2	210	EAC-8	1	YES
7/2	211	EA-8	1	
7/3	229	EAC-8	2	YES
7/3	230	EA-8	4	
7/7	248	EAC-8	invalid	NA
7/7	249*	EA-8	ND	
7/8	267	EAC-8	4	YES
7/8	268	EA-8	1	
7/9	286	EAC-8	3	YES
7/9	287	EA-8	3	
7/9 - 7/10	301	EAC-8	1	NA
7/9 - 7/10	302	EA-8	invalid	

EA = East Side Lower Field
EAC = East Side Lower Field (Collocated)
ND = not detected
* This sample was reanalyzed and results verified during standard QC testing

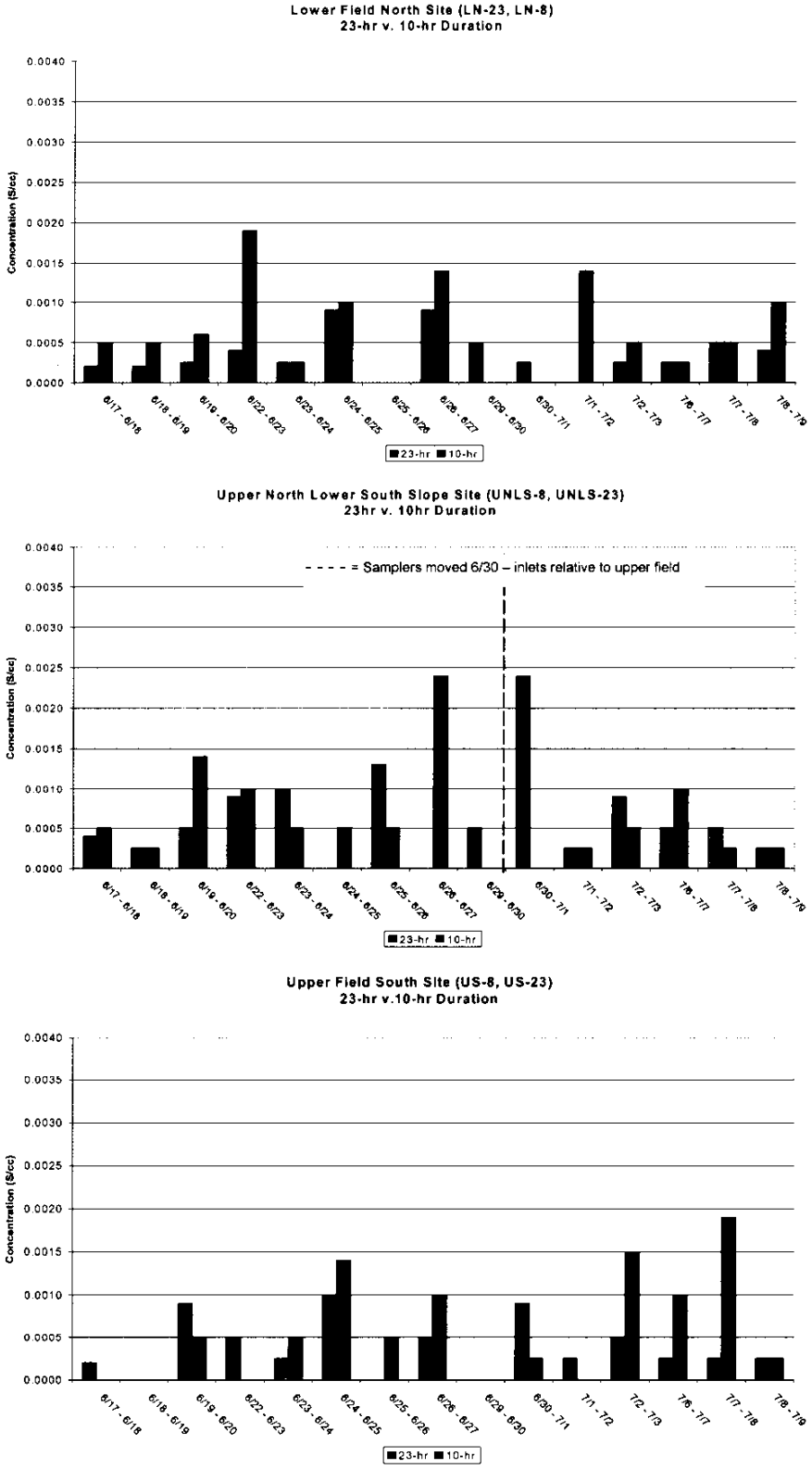
Table 8 Collocated Results – 23-Hour Receptor Site

Sampling Date (start - end)	Sample Log#	Sampling Location	Number of Fibers Detected	Within 95% Confidence
6/16 - 6/17	7	CdS E	ND	YES
6/16 - 6/17	8[7]	CdS W	1	
6/17 - 6/18	18	CdS E	ND	YES
6/17 - 6/18	19	CdS W	ND	
6/18 - 6/19	30	CdS E	ND	YES
6/18 - 6/19	31	CdS W	1	
6/19 - 6/20	43	CdS E	ND	YES
6/19 - 6/20	44*	CdS W	ND	
6/22 - 6/23	66	CdS E	1	YES
6/22 - 6/23	67	CdS W	ND	
6/23 - 6/24	83	CdS E	ND	YES
6/23 - 6/24	84	CdS W	3	
6/24 - 6/25	100	CdS E	ND	YES
6/24 - 6/25	101	CdS W	1	
6/25 - 6/26	120	CdS E	1	YES
6/25 - 6/26	121	CdS W	ND	
6/26 - 6/27	139	CdS E	ND	YES
6/26 - 6/27	140	CdS W	1	
6/29 - 6/30	158	CdS E	1	YES
6/29 - 6/30	159	CdS W	ND	
6/30 - 7/1	179	CdS E	ND	YES
6/30 - 7/1	180	CdS W	ND	
7/1 - 7/2	198	CdS E	2	YES
7/1 - 7/2	199	CdS W	ND	
7/2 - 7/3	217	CdS E	5	NA
7/2 - 7/3	218	CdS W	invalid	
7/6 - 7/7	236*	CdS E	2	YES
7/6 - 7/7	237	CdS W	ND	
7/7 - 7/8	255	CdS E	2	YES
7/7 - 7/8	256	CdS W	ND	
7/8 - 7/9	274	CdS E	4	YES
7/8 - 7/9	275*	CdS W	2	

CdS E = Cul-de-Sac House (east sampler)
CdS W = Cul-de-Sac House (west sampler)
ND = not detected
* This sample was reanalyzed and results verified during standard QC testing

7 This collocated sampler was not scheduled to run on this day and ran for 11 hours instead of 23 hours.

Figure 7 10-hour v. 23-hour Comparison – Fenceline Sites



VII. Laboratory Results

The seventeen days of sampling resulted in 303 samples. A total of 260 valid samples were obtained for this project, including two hundred twenty-four field samples, thirty-four blanks (trip and field blanks) and two performance evaluation samples. Forty-three samples were invalidated due to sampler malfunction, unstable flow rates, overloading, etc.

Several of the air samplers had a deviation in flow rate of more than 1.0 liter per minute (10%) from starting reading to end reading. Thirty-two of the samplers had flow rate deviations from start to end of 25% or more and the samples collected were considered unstable and therefore invalid. Summary results are presented in Tables 9 through 11. Daily concentration results are presented in Tables 12 through 28 below and are recorded on site diagrams in Attachment 3. Figure 8 is a graph of daily concentrations. Throughout this report, ½ the detection limit was used for calculations and graphs when the concentration was reported as < detection limit (i.e., 0.00025 was used when <0.0005 was reported).

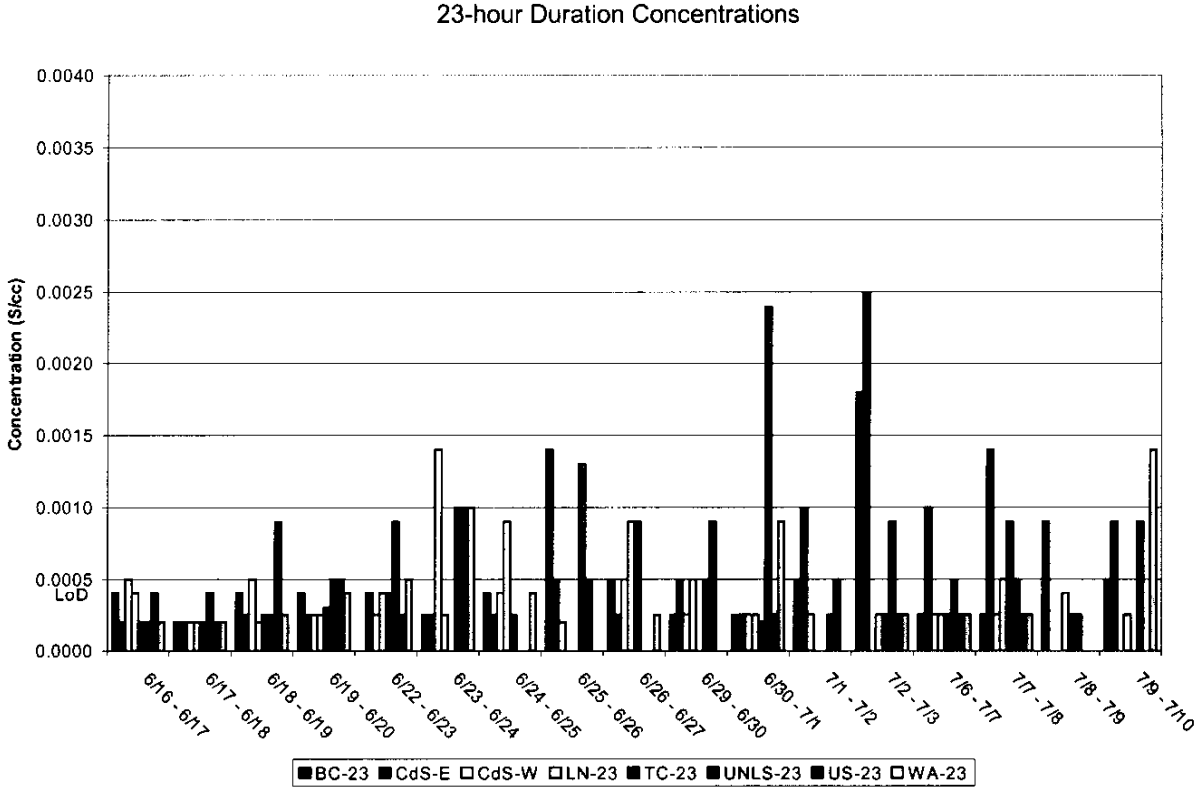
Table 9 Daily Asbestos Fiber Count and Total Average Asbestos Concentrations

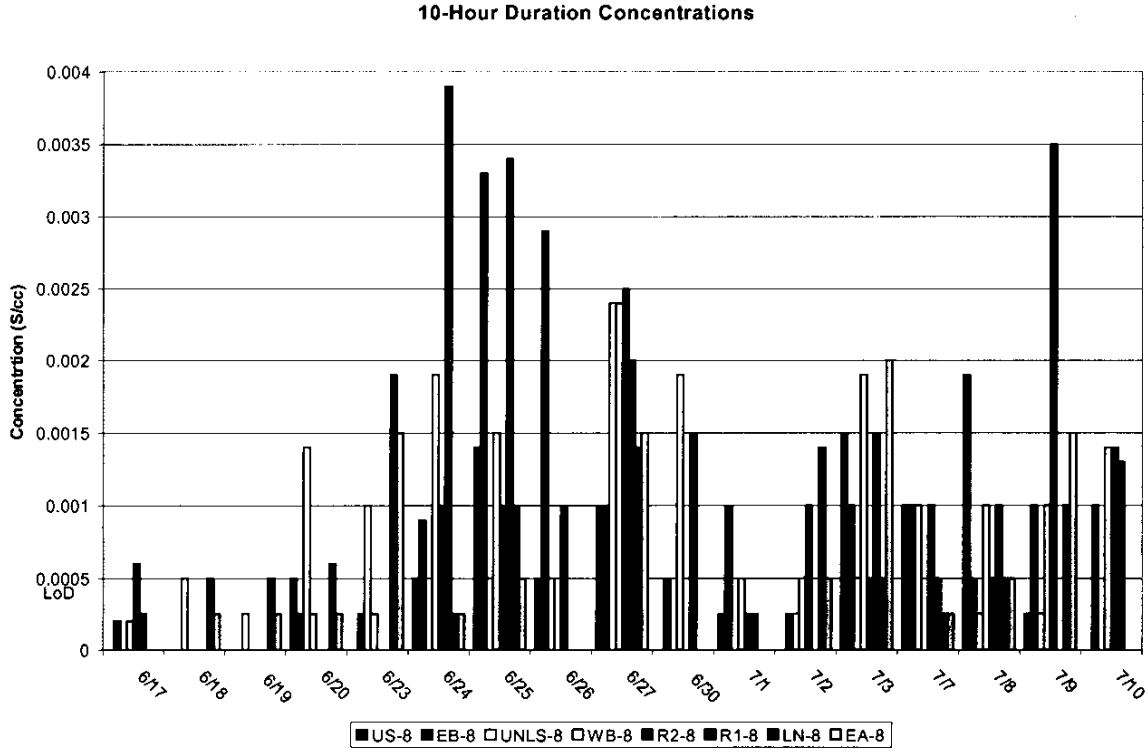
Sampling Date	Total Chrysotile Structures	Total Amphibole Structures	Average Conc. <5μm (s/cc)	Average Conc. >5μm (s/cc)	Average Conc. All Structures (s/cc)
6/16 – 6/17/03	ND	5	<0.0005	<0.0005	<0.0005
6/17 – 6/18/03	ND	3	<0.0005	<0.0005	<0.0005
6/18 – 6/19/03	ND	3	<0.0005	<0.0005	<0.0005
6/19 – 6/20/03	ND	12	<0.0005	<0.0005	0.0005
6/22 – 6/23/03	ND	18	<0.0005	0.0006	0.0007
6/23 – 6/24/03	ND	25	<0.0005	0.0008	0.0009
6/24 – 6/25/03	ND	36	<0.0005	0.0008	0.0011
6/25 – 6/26/03	1	16	<0.0005	0.0010	0.0010
6/26 – 6/27/03	ND	38	<0.0005	0.0009	0.0012
6/29 – 6/30/03	ND	11	<0.0005	0.0006	0.0007
6/30 – 7/1/03	ND	12	<0.0005	0.0006	0.0007
7/1 – 7/2/03	ND	11	<0.0005	<0.0005	0.0006
7/2 – 7/3/03	6	27	0.0007	0.0006	0.0011
7/6 – 7/7/03	ND	12	<0.0005	<0.0005	0.0006
7/7 – 7/8/03	ND	23	<0.0005	0.0005	0.0007
7/8 – 7/9/03	1	21	0.0005	0.0006	0.0009
7/9 – 7/10/03	ND	20	<0.0005	0.0008	0.0010

The goal of sampling a minimum of 11,000 L and 23 hours under a stable flow rate was met for 68% (85 of 124[8]) of the receptor air samples. The goal of sampling a minimum of 4800 L under a stable flow rate was met for 94% (94 of 100) of the fenceline air samples.

[8] This total includes perimeter monitors run for 23 hours during background sampling.

Figure 8 Daily Concentrations



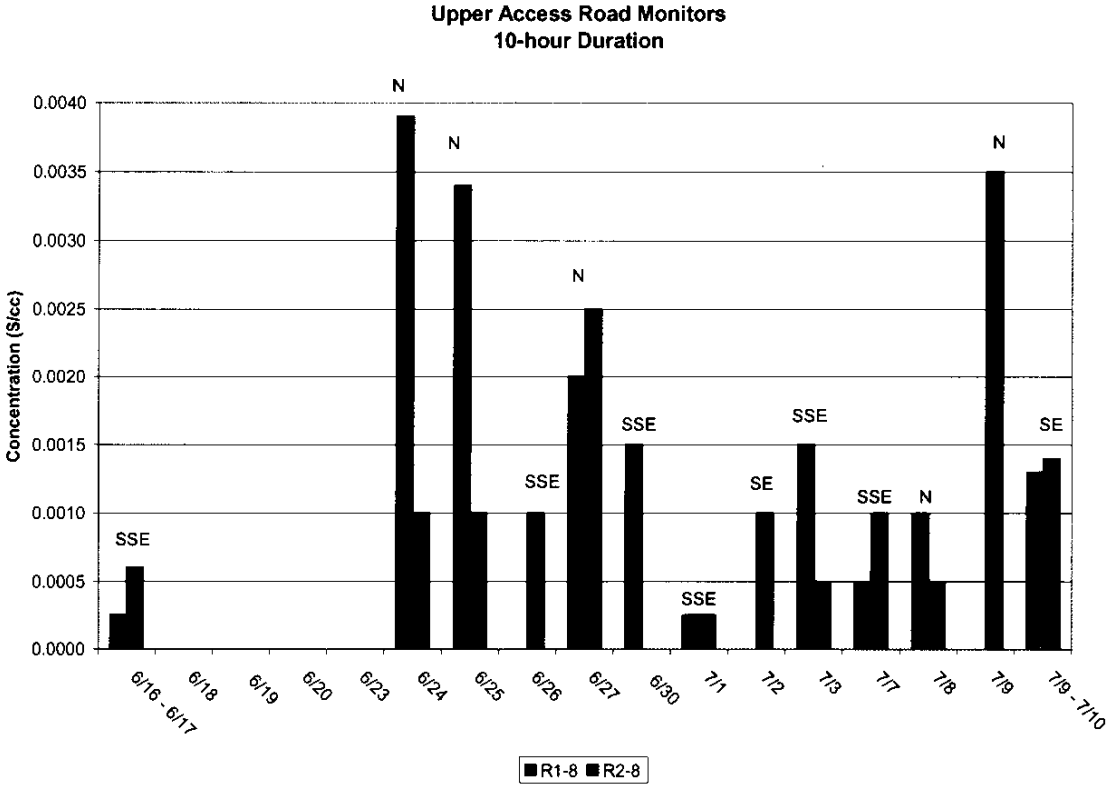


Thirty seven percent (37%) of all samples had asbestos concentrations below the level of detection. The majority of asbestos fibers detected were the amphibole actinolite. Overall, 293 amphibole fibers and eight chrysotile fibers were detected during the monitoring. Six of the eight chrysotile fibers were found on samples collected on 7/3/03. Eighteen tremolite and two anthophyllite amphibole fibers were also detected. More than 70 percent of structures detected were greater than 5μm in length.

The overall average asbestos concentration was 0.0008 s/cc. The average concentration of 10-hour duration samples was 0.0010 s/cc. The average of 23-hour duration samples was 0.0005 s/cc.

R-1 (upper field access road sampler) exhibited the overall highest concentration of 0.0039 s/cc on 6/24/03. Fence post holes were dug on the upper field on that day. The R-1 and R-2 samplers had the highest concentrations on North wind days as indicated in Figure 9.

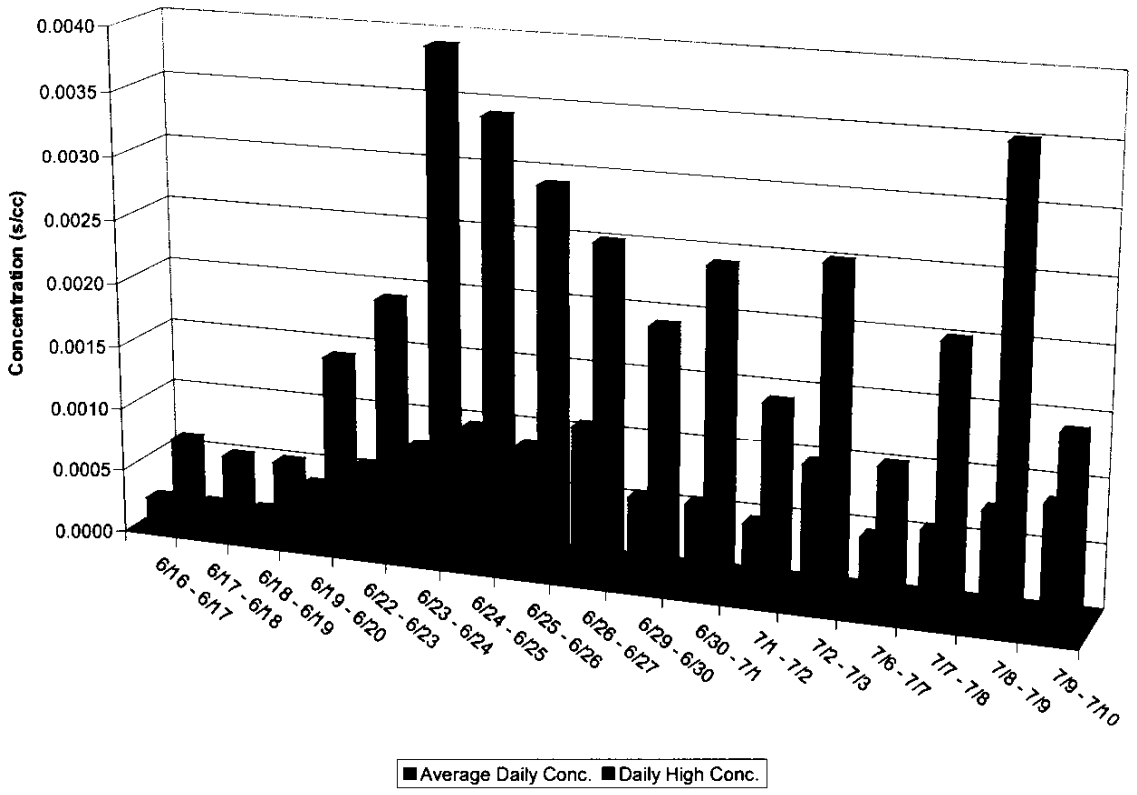
Figure 9 Upper Field Access Road Monitor Results



Of the twenty samples with the highest concentrations, ranging from 0.0015 to 0.0039 s/cc, sixteen were collected on days of activities that disturbed the original slopes or fills on one or both fields, as shown in Table 10. These activities include wetting and rolling weeds, fabric placement, initial placement of clean fill, digging fence post holes, cutting weeds or pinning mesh on slopes, and applying shotcrete on slopes. The sampler on the west side of the upper field (WB-8) had four samples

with concentrations ≥0.0019 s/cc. This site had the most samples with high concentrations. Figure 10 shows the highest daily concentration relative to the daily average concentrations.

Figure 10 Daily High vs Daily Average Concentrations



The distribution of asbestos concentrations relative to the AHERA classroom clearance level of 0.02 s/cc is shown in Figure 11 and Figure 12. None of the samples had concentrations above the clearance level. Ninety-five percent of the 224 valid samples were at or below 0.002 s/cc, which is ten times less than the clearance level. The median concentration was 0.0005 s/cc with the mode at <0.0005.

Figure 11 Asbestos Concentration Distribution

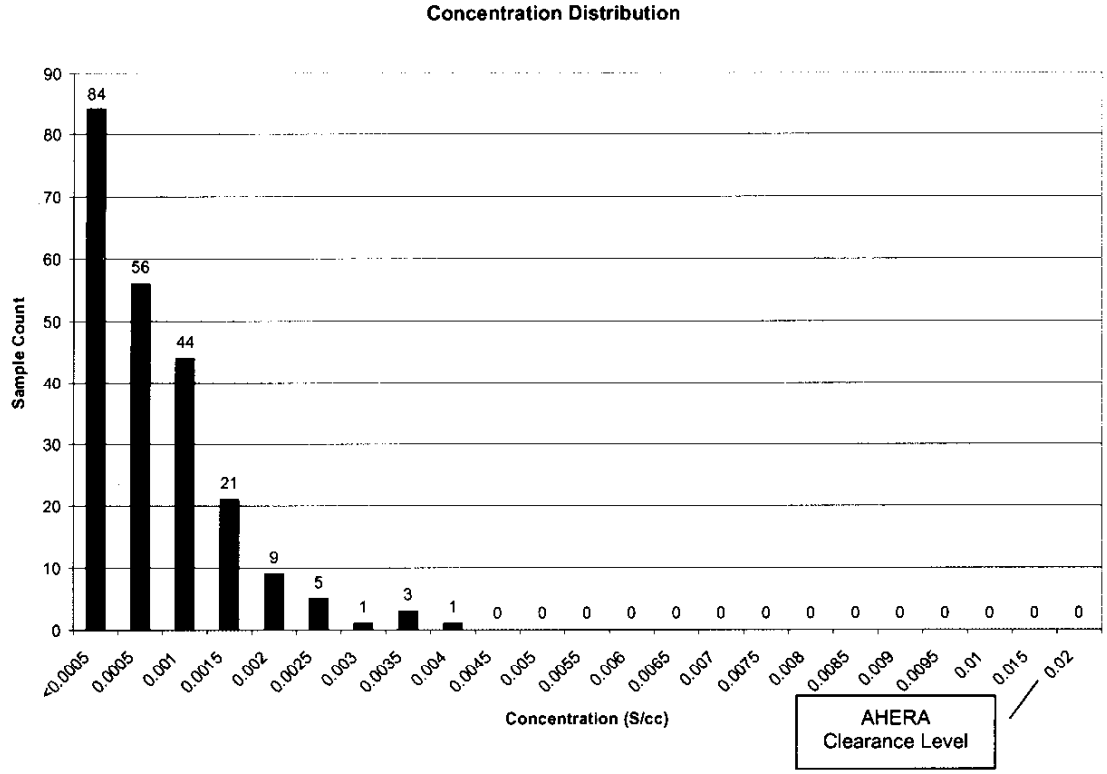


Figure 12 Concentration Percentiles

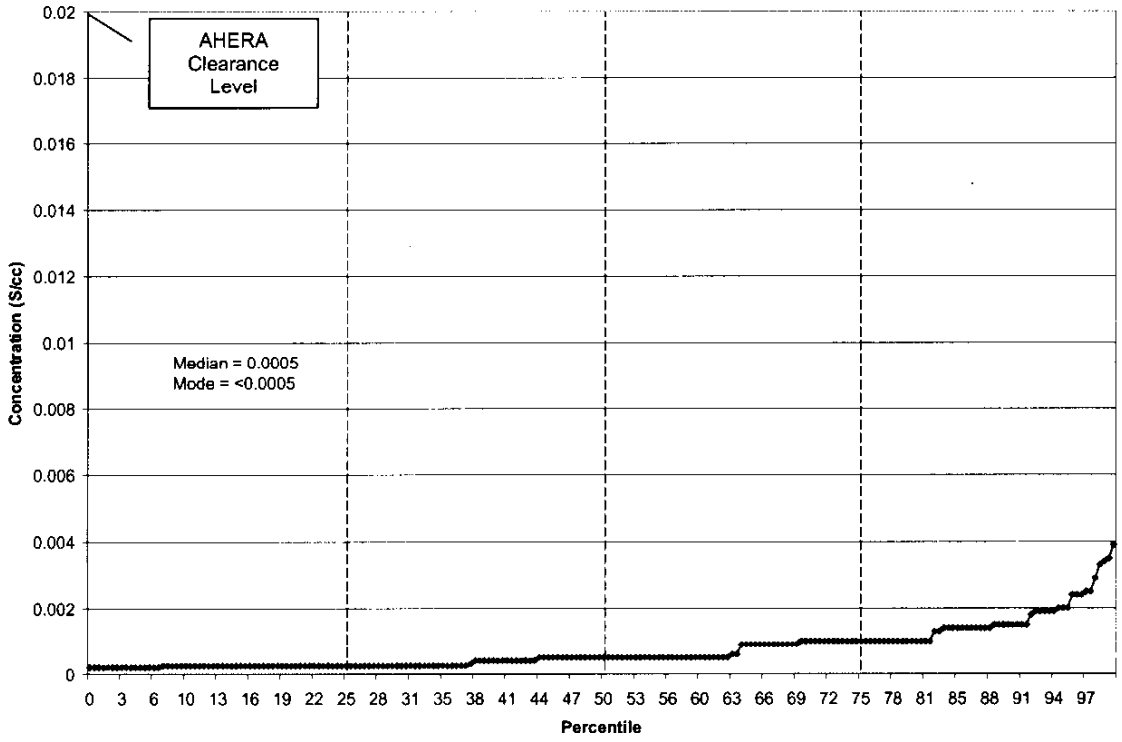


Table 10 Highest Concentrations vs Activity

Sampling Date	Sampling Location	Conc. All Structures (s/cc)	Wind Direction (upper field met)	Upper Field Activity[9]	Lower Field Activity
6/23	EA-8	0.0015	N/SSE	Dug post holes, post installation, fabric placement	Wet and rolled weeds
6/23	LN-8	0.0019			
6/24	R1-8	0.0039	N	Fabric placement, poured footings, 6" fill dirt	Fabric placement, dug post holes
6/24	WB-8	0.0019			
6/25	R1-8	0.0034	N	12" fill dirt on half of field	Fence post installation
6/25	EB-8	0.0033			
6/26	EB-8	0.0029	SSE	12" fill dirt on 2/3 of field, poured footings	Dug post holes near access road
6/27	R2-8	0.0025	N	12" fill dirt on ¾ of field	Dug post holes
6/27	WB-8	0.0024			
6/27	UNLS-8	0.0024			
6/27	R1-8	0.0020			
6/29 - 6/30	WB-8	0.0019	SSE	12" fill dirt on all of field, pinned mesh on slope	No activity
6/30 - 7/1	UNLS-23	0.0024	SSE	Cut weeds on west slope	Dug trench and basin for decon pit, 12" fill dirt on ½ of field
7/3	EA-8	0.0020	SSE	Wet field	Wet field, added fill dirt
7/2 - 7/3	BC-23	0.0018			
7/2 - 7/3	CdS E	0.0025			
7/3	WB-8	0.0019			
7/8	EAC-8	0.0020	N	Shotcrete on slope, 24" fill dirt on ½ field	24" fill dirt on all of field
7/8	US-8	0.0019			
7/9	R2-8	0.0035	N	Shotcrete on slope, 24" fill dirt on all of field	No activity

[9] See Table 1 for detailed activities.

Table 11 Daily Concentration Summary

Sampling Date	Lower Field Activity [10]	Upper Field Activity	Expected # Samples	# Valid Samples Collected	# Valid Samples ≥ LoD[11]	Percent ≥ LoD	Highest Daily Concentration (s/cc)
6/16 – 6/17/03	No activity	No activity	12	12	5	42%	0.0006
6/17 – 6/18/03	Decon pad, rolled weeds	No activity	12	12	3	25%	0.0005
6/18 – 6/19/03	Rolled weeds, dug post holes	No activity	11	11	3	27%	0.0005
6/19 – 6/20/03	Rolled weeds, dug post holes, post installation, fabric placement	Decon pad, road base on access road	15	15	8	53%	0.0014
6/22 – 6/23/03	Dug post holes, post installation, fabric placement	Wet and rolled weeds	17	13	10	77%	0.0019
6/23 – 6/24/03	Fabric placement, poured footings, 6" fill dirt	Fabric placement, dug post holes	17	16	9	56%	0.0039
6/24 – 6/25/03	12" fill dirt on half of field	Fence post installation	17	16	14	88%	0.0034
6/25 – 6/26/03	12" fill dirt on 2/3 of field, poured footings	Dug post holes near access road	17	8	7	88%	0.0029
6/26 – 6/27/03	12" fill dirt on 3/4 of field	Dug post holes	17	16	14	88%	0.0025
6/29 – 6/30/03	12" fill dirt on all of field, pinned mesh on slope	No activity	17	9	6	67%	0.0019
6/30 – 7/1/03	Cut weeds on west slope	Dug trench and basin for decon pit, 12" fill dirt on ½ of field	17	13	5	20%	0.0024
7/1 – 7/2/03	Covered decon pad with fill dirt	12" fill dirt on all of field	17	12	7	58%	0.0014
7/2 – 7/3/03	Wet field	Wet field, added fill dirt	17	16	13	81%	0.0025
7/6 – 7/7/03	Shotcrete on slope	24" fill dirt on ½ of field	17	15	7	47%	0.0010
7/7 – 7/8/03	Shotcrete on slope, 24" fill dirt on ½ field	24" fill dirt on all of field	17	17	12	71%	0.0020
7/8 – 7/9/03	Shotcrete on slope, 24" fill dirt on all of field	No activity	17	13	8	62%	0.0035
7/9 – 7/10/03	No activity	No activity	12	10	9	90%	0.0014
		GRAND TOTAL[12]	**266**	**224**	**140**		
		OVERALL % > LOD				**63%**	
		OVERALL HIGH CONC.					**0.0039**
		OVERALL AVERAGE CONC.					**0.0008**

[10] See Table 1 for detailed activities.
[11] Level of Detection (LoD) = 0.0005
[12] Totals do not include field or trip blanks.

Table 12 Daily Concentrations Pre-mitigation Background

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5µm (s/cc)	Conc. >5µm (s/cc)	Conc. All Structures (s/cc)	Comments
6/16 - 6/17	1	BC-23	ND	1	0.0004	<0.0004	**0.0004**	One actinolite by SAED/EDX
6/16 - 6/17	2	R1-8	ND	ND	< 0.0005	<0.0005	**<0.0005**	
6/16 - 6/17	3	R2-8	ND	1	0.0006	< 0.0006	**0.0006**	One actinolite by SAED/EDX
6/16 - 6/17	4	US-23	ND	1	0.0004	<0.0004	**0.0004**	One actinolite by SAED/EDX
6/16 - 6/17	5	WB-8	ND	ND	< 0.0004	<0.0004	**<0.0004**	
6/16 - 6/17	6	EB-8	ND	ND	< 0.0004	<0.0004	**<0.0004**	
6/16 - 6/17	7	CdS E	ND	ND	< 0.0004	< 0.0004	**< 0.0004**	
6/16 - 6/17	8	CdS W	ND	1	0.0005	<0.0005	**0.0005**	One actinolite by SAED/EDX
6/16 - 6/17	9	WA-23	ND	ND	< 0.0004	<0.0004	**<0.0004**	
6/16 - 6/17	10	UNLS-23	ND	ND	< 0.0004	<0.0004	**<0.0004**	
6/16 - 6/17	11	EA-8	--	--	--	--	**--**	INVALID
6/16 - 6/17	12	EAC-8	--	--	--	--	**--**	INVALID
6/16 - 6/17	13	LN-23	ND	1	< 0.0004	0.0004	**0.0004**	One actinolite by SAED/EDX
6/16 - 6/17	14	TC-23	ND	ND	< 0.0004	< 0.0004	**< 0.0004**	
		Daily Total	**ND**	**5**				
				Daily Average	**<0.0005**	**<0.0005**	**<0.0005**	Averages do not include blanks ½ LoD used in calculations for <

Table 13 Daily Concentrations 6/17 – 6/18

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (Sscc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
6/17 - 6/18	15	BC-23	ND	ND	< 0.0004	< 0.0004	**< 0.0004**	
6/17 - 6/18	16	US-23	ND	ND	< 0.0004	< 0.0004	**< 0.0004**	
6/17 - 6/18	17	Trip Blank	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	Trip Blank
6/17 - 6/18	18	CdS E	ND	ND	< 0.0004	< 0.0004	**< 0.0004**	
6/17 - 6/18	19	CdS W	ND	ND	< 0.0004	< 0.0004	**< 0.0004**	
6/17 - 6/18	20	WA-23	ND	ND	< 0.0004	< 0.0004	**< 0.0004**	
6/17 - 6/18	21	UNLS-23	ND	1	< 0.0004	0.0004	**0.0004**	One actinolite by SAED/EDX
6/18	22	UNLS-8	ND	1	< 0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/18	23	EA-8	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	
6/18	24	EAC-8	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	
6/17 - 6/18	25	LN-23	ND	ND	< 0.0004	< 0.0004	**< 0.0004**	
6/18	26	LN-8	ND	1	< 0.0005	0.0005	**0.0005**	One tremolite by SAED/EDX
6/17 - 6/18	27	TC-23	ND	ND	< 0.0004	< 0.0004	**< 0.0004**	
6/17 - 6/18	28	Trip Blank	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	Trip Blank
6/17 - 6/18	28TB	Trip Blank	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	Trip Blank
6/18 - 6/18	28FB	Field Blank	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	Field Blank
		Daily Total	**ND**	**3**				
				Daily Average	**<0.0005**	**<0.0005**	**<0.0005**	Averages do not include blanks ½ LoD used in calculations for <

Table 14 Daily Concentrations 6/18 – 6/19

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (scc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
6/18 - 6/19	29	BC-23	ND	1	< 0.0004	0.0004	**0.0004**	One actinolite by SAED/EDX
6/18 - 6/19	30	CdS E	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	
6/18 - 6/19	31	CdS W	ND	1	< 0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/18 - 6/19	32	WA-23	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	
6/18 - 6/19	33	UNLS-23	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	
6/19	34	UNLS-8	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	
6/19	35	EA-8	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	
6/19	36	EAC-8	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	
6/18 - 6/19	37	LN-23	ND	ND	< 0.0004	< 0.0004	**< 0.0004**	
6/19	38	LN-8	ND	1	<0.0005	0.0005	**0.0005**	One anthophyllite by SAED/EDX
6/18 - 6/19	39	TC-23	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	
6/19	40	Field Blank	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	Trip Blank
6/19	41	Trip Blank	ND	ND	< 0.0005	< 0.0005	**< 0.0005**	Trip Blank
		Daily Total	**ND**	**3**				
				Daily Average	**<0.0005**	**<0.0005**	**<0.0005**	Averages do not include blanks ½ LoD used in calculations for <

Table 15 Daily Concentrations 6/19 – 6/20

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (s/cc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
6/19 - 6/20	42	BC-23	ND	1	<0.0004	0.0004	**0.0004**	One actinolite by SAED/EDX
6/19 - 6/20	43	CdS E	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/19 - 6/20	44	CdS W	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/19 - 6/20	45	TC-23	ND	ND	<0.0006	<0.0006	**<0.0006**	
6/19 - 6/20	46	LN-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/20	47	LN-8	ND	1	<0.0006	0.0006	**0.0006**	One actinolite by SAED/EDX
6/19 - 6/20	48	WA-23	ND	1	<0.0004	0.0004	**0.0004**	One actinolite by SAED/EDX
6/19 - 6/20	49	UNLS-23	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/20	50	UNLS-8	ND	3	0.0005	0.0010	**0.0014**	Two actinolite and one tremolite by SAED/EDX
6/20	51	EA-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/20	52	EAC-8	ND	2	<0.0005	0.0010	**0.0010**	One actinolite and one tremolite by SAED/EDX
6/19 - 6/20	53	US-23	ND	2	<0.0004	0.0009	**0.0009**	Two actinolite by SAED/EDX
6/20	54	US-8	ND	1	0.0005	<0.0005	**0.0005**	One actinolite by SAED/EDX
6/20	55	WB-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/20	56	EB-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/20	57TB	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
6/20	58FB	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
		Daily Total	**ND**	**12**				
				Daily Average	**<0.0005**	**<0.0005**	**0.0005**	Averages do not include blanks ½ LoD used in calculations for <

Table 16 Daily Concentrations 6/22 – 6/23

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5µm (s/cc)	Conc. >5µm (s/cc)	Conc. All Structures (s/cc)	Comments
6/22 - 6/23	59	BC-23	--	--	--	--	--	INVALID
6/23	60	R1-8	--	--	--	--	--	INVALID
6/23	61	R2-8	--	--	--	--	--	INVALID
6/22 - 6/23	62	US-23	ND	1	<0.0005	0.0005	**0.0005**	One tremolite by SAED/EDX
6/23	63	US-8	--	--	--	--	--	INVALID
6/23	64	WB-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/23	65	EB-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/23	66	CdS E	ND	1	<0.0004	0.0004	**0.0004**	One actinolite by SAED/EDX
6/22 - 6/23	67	CdS W	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/22 - 6/23	68	WA-23	ND	1	<0.0005	0.0005	**0.0005**	One tremolite by SAED/EDX
6/22 - 6/23	69	UNLS-23	ND	2	<0.0005	0.0009	**0.0009**	Three actinolite by SAED/EDX
6/23	70	UNLS-8	ND	2	0.0005	0.0005	**0.0010**	One actinolite and one tremolite by SAED/EDX
6/23	71	EA-8	ND	3	0.0005	0.0010	**0.0015**	Three actinolite by SAED/EDX
6/23	72	EAC-8	ND	2	0.0005	0.0005	**0.0010**	Two actinolite by SAED/EDX
6/22 - 6/23	73	LN-23	ND	1	<0.0004	0.0004	**0.0004**	One actinolite by SAED/EDX
6/23	74	LN-8	ND	4	<0.0005	0.0019	**0.0019**	Three actinolite and one tremolite by SAED/EDX
6/22 - 6/23	75	TC-23	ND	1	<0.0004	0.0004	**0.0004**	One actinolite by SAED/EDX
6/23	76	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
6/23	77	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
6/22 - 6/23	78	PE	--	--	--	--	--	VALID
		Daily Total	**ND**	**18**				
				Daily Average	**<0.0005**	**0.0006**	**0.0007**	Averages do not include blanks ½ LoD used in calculations for <

Table 17 Daily Concentrations 6/23 – 6/24

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (s/cc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
6/23 - 6/24	79	BC-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/24	80	R1-8	ND	8	0.0005	0.0034	**0.0039**	Eight actinolite by SAED/EDX
6/24	81	R2-8	ND	2	0.0005	0.0005	**0.0010**	Two actinolite by SAED/EDX
6/23 - 6/24	82	US-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/23 - 6/24	83	CdS E	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/23 - 6/24	84	CdS W	ND	3	<0.0005	0.0014	**0.0014**	Three actinolite by SAED/EDX
6/23 - 6/24	85	WA-23	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
6/23 - 6/24	86	UNLS-23	ND	2	<0.0005	0.0010	**0.0010**	One actinolite and one tremolite by SAED/EDX
6/24	87	UNLS-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/23 - 6/24	88	LN-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/23 - 6/24	89	TC-23	--	--	--	--	--	INVALID
6/24	90	US-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/24	91	WB-8	ND	4	0.0005	0.0014	**0.0019**	Four actinolite by SAED/EDX
6/24	92	EB-8	ND	2	0.0005	0.0005	**0.0009**	Two actinolite by SAED/EDX
6/24	93	EA-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/24	94	EAC-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/24	95	LN-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/24	96FB	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
6/24	97TB	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
		Daily Total	**ND**	**25**				
				Daily Average	**<0.0005**	**0.0008**	**0.0009**	Averages do not include blanks ½ LoD used in calculations for <

Table 18 Daily Concentrations 6/24 – 6/25

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (s/cc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
6/24 - 6/25	98	BC-23	ND	1	<0.0004	0.0004	**0.0004**	One actinolite by SAED/EDX
6/24 - 6/25	99	US-23	ND	2	0.0005	0.0005	**0.0010**	Two actinolite by SAED/EDX
6/24 - 6/25	100	CdS E	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/24 - 6/25	101	CdS W	ND	1	<0.0004	0.0004	**0.0004**	One actinolite by SAED/EDX
6/24 - 6/25	102	UNLS-23	--	--	--	--	--	INVALID
6/25	103	UNLS-8	ND	1	0.0005	<0.0005	**0.0005**	One actinolite by SAED/EDX
6/24 - 6/25	104	WA-23	ND	1	<0.0004	0.0004	**0.0004**	One actinolite by SAED/EDX
6/24 - 6/25	105	LN-23	ND	2	<0.0004	0.0009	**0.0009**	Two actinolite by SAED/EDX
6/24 - 6/25	106	TC-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/25	107	R1-8	ND	7	0.0010	0.0024	**0.0034**	Seven actinolite by SAED/EDX
6/25	108	R2-8	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
6/25	109	US-8	ND	3	0.0010	0.0005	**0.0014**	Three actinolite by SAED/EDX
6/25	110	WB-8	ND	3	<0.0005	0.0015	**0.0015**	Three actinolite by SAED/EDX
6/25	111	EB-8	ND	7	0.0014	0.0019	**0.0033**	Seven actinolite by SAED/EDX
6/25	112	LN-8	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
6/25	113	EAC-8	ND	3	0.0010	0.0005	**0.0015**	Three actinolite by SAED/EDX
6/25	114	EA-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/25	115TB	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
6/25	116FB	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
		Daily Total	**ND**	**36**				
				Daily Average	**<0.0005**	**0.0008**	**0.0011**	Averages do not include blanks ½ LoD used in calculations for <

Table 19 Daily Concentrations 6/25 – 6/26

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (s/cc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
6/25 - 6/26	117	BC-23	ND	3	<0.0005	0.0014	**0.0014**	Three actinolite by SAED/EDX
6/26	118	R1-8	--	--	--	--	--	INVALID
6/26	119	R2-8	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
6/25 - 6/26	120	CdS E	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/25 - 6/26	121	CdS W	ND	ND	<0.0004	<0.0004	**<0.0004**	
6/25 - 6/26	122	US-23	--	--	--	--	**--**	INVALID
6/26	123	US-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/26	124	WB-8	--	--	--	--	**--**	INVALID
6/25 - 6/26	125	UNLS-23	ND	3	<0.0004	0.0013	**0.0013**	Three actinolite by SAED/EDX
6/26	126	UNLS-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/26	127	EB-8	1	5	<0.0005	0.0029	**0.0029**	One chrysotile, four actinolite and one tremolite by SAED/EDX
6/25 - 6/26	128	TC-23	--	--	--	--	**--**	INVALID
6/25 - 6/26	129	WA-23	--	--	--	--	**--**	INVALID
6/25 - 6/26	130	LN-23	--	--	--	--	**--**	INVALID
6/26	131	LN-8	--	--	--	--	**--**	INVALID
6/26	132	EAC-8	--	--	--	--	**--**	INVALID
6/26	133	EA-8	--	--	--	--	**--**	INVALID
6/25 - 6/26	134	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
6/26	135	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
		Daily Total	**1**	**16**				
				Daily Average	**<0.0005**	**0.0010**	**0.0010**	Averages do not include blanks ½ LoD used in calculations for <

Table 20 Daily Concentrations 6/26 – 6/27

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (s/cc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
6/26 - 6/27	136	BC-23	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/27	137	R1-8	ND	4	0.0005	0.0015	**0.0020**	Four actinolite by SAED/EDX
6/27	138	R2-8	ND	5	<0.0005	0.0025	**0.0025**	Five actinolite by SAED/EDX
6/26 - 6/27	139	CdS E	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/26 - 6/27	140	CdS W	ND	1	0.0005	<0.0005	**0.0005**	One actinolite by SAED/EDX
6/26 - 6/27	141	US-23	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/27	142	US-8	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
6/27	143	WB-8	ND	5	0.0014	0.0010	**0.0024**	Three actinolite and two tremolite by SAED/EDX
6/26 - 6/27	144	UNLS-23	--	--	--	--	--	INVALID
6/27	145	UNLS-8	ND	5	0.0005	0.0019	**0.0024**	Five actinolite by SAED/EDX
6/27	146	EB-8	ND	2	0.0005	0.0005	**0.0010**	Two actinolite by SAED/EDX
6/26 - 6/27	147	TC-23	ND	2	0.0005	0.0005	**0.0009**	One actinolite and one tremolite by SAED/EDX
6/26 - 6/27	148	WA-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/26 - 6/27	149	LN-23	ND	2	<0.0005	0.0009	**0.0009**	Two actinolite by SAED/EDX
6/27	150	LN-8	ND	3	0.0005	0.0010	**0.0014**	Three actinolite by SAED/EDX
6/27	151	EAC-8	ND	2	0.0005	0.0005	**0.0010**	Two actinolite by SAED/EDX
6/27	152	EA-8	ND	3	<0.0005	0.0015	**0.0015**	Three actinolite by SAED/EDX
6/27	153TB	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
6/27	154FB	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
		Daily Total	**ND**	**38**				
				Daily Average	**<0.0005**	**0.0009**	**0.0012**	Averages do not include blanks ½ LoD used in calculations for <

Table 21 Daily Concentrations 6/29 – 6/30

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (s/cc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
6/29 - 6/30	155	BC-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/30	156	R1-8	ND	3	<0.0005	0.0015	**0.0015**	Three actinolite by SAED/EDX
6/30	157	R2-8	--	--	--	--	**--**	INVALID
6/29 - 6/30	158	CdS E	ND	1	<0.0005	0.0005	**0.0005**	One tremolite by SAED/EDX
6/29 - 6/30	159	CdS W	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/29 - 6/30	160	US-23	--	--	--	--	**--**	INVALID
6/29	161	US-8	--	--	--	--	**--**	INVALID
6/29 - 6/30	162	WB-8	ND	4	0.0005	0.0014	**0.0019**	Four actinolite by SAED/EDX
6/30	163	UNLS-8	--	--	--	--	**--**	INVALID
6/29 - 6/30	164	UNLS-23	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/30	165	EB-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
6/29 - 6/30	166	WA-23	--	--	--	--	**--**	INVALID
6/29 - 6/30	167	LN-23	ND	1	0.0005	<0.0005	**0.0005**	One actinolite by SAED/EDX
6/30	168	LN-8	--	--	--	--	**--**	INVALID
6/30	169	EAC-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/30	170	EA-8	--	--	--	--	**--**	INVALID
6/29 - 6/30	171	TC-23	--	--	--	--	**--**	INVALID
6/30	172	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
6/30	173	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
--	174,175	--	--	--	--	--	**--**	log numbers not used
		Daily Total	**ND**	**11**				
				Daily Average	**<0.0005**	**0.0006**	**0.0007**	Averages do not include blanks ½ LoD used in calculations for <

Table 22 Daily Concentrations 6/30 – 7/1

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (s/cc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
6/30 - 7/1	176	BC-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/1	177	R1-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/1	178	R2-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/30 - 7/1	179	CdS E	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/30 - 7/1	180	CdS W	ND	ND	<0.0005	<0.0005	**<0.0005**	
6/30 - 7/1	181	US-23	ND	2	<0.0004	0.0009	**0.0009**	Two actinolite by SAED/EDX, moved sampler 12 feet south
7/1	182	US-8	ND	ND	<0.0005	<0.0005	**<0.0005**	Moved sampler 12 feet south
7/1	183	WB-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
7/1	184	UNLS-8	--	--	--	--	**--**	INVALID
6/30 - 7/1	185	UNLS-23	ND	5	<0.0005	0.0024	**0.0024**	Five actinolite by SAED/EDX
7/1	186	EB-8	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
6/30 - 7/1	187	TC-23	ND	ND	<0.0004	<0.0004	**<0.0004**	
6/30 - 7/1	188	LN-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/1	189	LN-8	--	--	--	--	**--**	INVALID
7/1	190	EAC-8	--	--	--	--	**--**	INVALID
7/1	191	EA-8	--	--	--	--	**--**	INVALID
6/30 - 7/1	192	WA-23	ND	2	0.0005	0.0005	**0.0009**	Two tremolite by SAED/EDX
7/1	193TB	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
7/1	194FB	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
		Daily Total	**ND**	**12**				
				Daily Average	**<0.0005**	**0.0006**	**0.0007**	Averages do not include blanks ½ LoD used in calculations for <

Table 23 Daily Concentrations 7/1 – 7/2

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (s/cc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
7/1 - 7/2	195	BC-23	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
7/2	196	R1-8	--	--	--	--	**--**	INVALID - not analyzed
7/2	197	R2-8	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
7/1 - 7/2	198	CdS E	ND	2	0.0005	0.0005	**0.0010**	Two actinolite by SAED/EDX
7/1 - 7/2	199	CdS W	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/1 - 7/2	200	US-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/2	201	US-8	--	--	--	--	**--**	INVALID - not analyzed
7/2	202	WB-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
7/1 - 7/2	203	UNLS-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/2	204	UNLS-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/2	205	EB-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/1 - 7/2	206	TC-23	--	--	--	--	**--**	INVALID - not analyzed
7/1 - 7/2	207	WA-23	--	--	--	--	**--**	INVALID - not analyzed
7/1 - 7/2	208	LN-23	--	--	--	--	**--**	INVALID - not analyzed
7/2	209	LN-8	ND	3	<0.0005	0.0014	**0.0014**	Three actinolite by SAED/EDX
7/2	210	EAC-8	ND	1	0.0005	<0.0005	**0.0005**	One actinolite by SAED/EDX
7/2	211	EA-8	ND	1	0.0005	<0.0005	**0.0005**	One actinolite by SAED/EDX
7/2	212	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
7/2	213	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
		Daily Total	**ND**	**11**				
				Daily Average	**<0.0005**	**<0.0005**	**0.0006**	Averages do not include blanks ½ LoD used in calculations for <

Table 24 Daily Concentrations 7/2 – 7/3

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5µm (s/cc)	Conc. >5µm (s/cc)	Conc. All Structures (s/cc)	Comments
7/2 - 7/3	214	BC-23	2	2	0.0009	0.0009	**0.0018**	Two actinolite by SAED/EDX
7/3	215	R1-8	ND	3	0.0005	0.0010	**0.0015**	Three actinolite by SAED/EDX
7/3	216	R2-8	ND	1	0.0005	<0.0005	**0.0005**	One actinolite by SAED/EDX
7/2 - 7/3	217	CdS E	3	2	0.0025	<0.0005	**0.0025**	Two actinolite by SAED/EDX
7/2 - 7/3	218	CdS W	--	--	--	--	**--**	INVALID - not analyzed
7/2 - 7/3	219	US-23	1	ND	0.0005	<0.0005	**0.0005**	
7/3	220	US-8	ND	3	0.0010	0.0005	**0.0015**	Three actinolite by SAED/EDX
7/3	221	WB-8	ND	4	0.0005	0.0014	**0.0019**	Four actinolite by SAED/EDX
7/2 - 7/3	222	UNLS-23	ND	2	0.0005	0.0005	**0.0009**	Two actinolite by SAED/EDX
7/3	223	UNLS-8	ND	1	0.0005	<0.0005	**0.0005**	One actinolite by SAED/EDX
7/3	224	EB-8	ND	2	0.0010	<0.0005	**0.0010**	Two actinolite by SAED/EDX
7/2 - 7/3	225	TC-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/2 - 7/3	226	WA-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/2 - 7/3	227	LN-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/3	228	LN-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
7/3	229	EAC-8	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
7/3	230	EA-8	ND	4	0.0010	0.0010	**0.0020**	Four actinolite by SAED/EDX
7/3	231	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
7/3	232	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
		Daily Total	**6**	**27**				
				Daily Average	**0.0007**	**0.0006**	**0.0011**	Averages do not include blanks ½ LoD used in calculations for <

Table 25 Daily Concentrations 7/6 – 7/7

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5µm (s/cc)	Conc. >5µm (s/cc)	Conc. All Structures (s/cc)	Comments
7/6 - 7/7	233	BC-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/7	234	R1-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
7/7	235	R2-8	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
7/6 - 7/7	236	CdS E	ND	2	0.0005	0.0005	**0.0010**	Two actinolite by SAED/EDX
7/6 - 7/7	237	CdS W	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/6 - 7/7	238	US-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/7	239	US-8	ND	2	0.0005	0.0005	**0.0010**	Two actinolite by SAED/EDX
7/7	240	WB-8	--	--	--	--	**--**	INVALID
7/6 - 7/7	241	UNLS-23	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
7/7	242	UNLS-8	ND	2	<0.0005	0.0010	**0.0010**	One actinolite and one tremolite by SAED/EDX
7/7	243	EB-8	ND	2	0.0005	0.0005	**0.0010**	Two actinolite by SAED/EDX
7/6 - 7/7	244	TC-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/6 - 7/7	245	WA-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/6 - 7/7	246	LN-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/7	247	LN-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/7	248	EAC-8	--	--	--	--	**--**	INVALID
7/7	249	EA-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/7	250	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
7/7	251	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
		Daily Total	**ND**	**12**				
				Daily Average	**<0.0005**	**<0.0005**	**0.0006**	Averages do not include blanks ½ LoD used in calculations for <

Table 26 Daily Concentrations 7/7 – 7/8

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (s/cc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
7/7 - 7/8	252	BC-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/8	253	R1-8	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
7/8	254	R2-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
7/7 - 7/8	255	CdS E	ND	3	0.0005	0.0010	**0.0014**	Three actinolite by SAED/EDX
7/7 - 7/8	256	CdS W	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/7 - 7/8	257	US-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/8	258	US-8	ND	4	0.0010	0.0010	**0.0019**	Two actinolite, one tremolite and one anthophylite by SAED/EDX
7/8	259	WB-8	ND	2	0.0005	0.0005	**0.0010**	Two actinolite by SAED/EDX
7/7 - 7/8	260	UNLS-23	ND	1	0.0005	<0.0005	**0.0005**	One actinolite by SAED/EDX
7/8	261	UNLS-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/8	262	EB-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
7/7 - 7/8	263	TC-23	ND	2	<0.0005	0.0009	**0.0009**	Two actinolite by SAED/EDX
7/7 - 7/8	264	WA-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/7 - 7/8	265	LN-23	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
7/8	266	LN-8	ND	1	0.0005	<0.0005	**0.0005**	One actinolite by SAED/EDX
7/8	267	EAC-8	ND	4	0.0010	0.0010	**0.0020**	Four actinolite by SAED/EDX
7/8	268	EA-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
7/8	269TB	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
7/8	270FB	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
		Daily Total	**ND**	**23**				
				Daily Average	**<0.0005**	**0.0005**	**0.0007**	Averages do not include blanks ½ LoD used in calculations for <

Table 27 Daily Concentrations 7/8 – 7/9

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (s/cc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
7/8 - 7/9	271	BC-23	ND	2	0.0005	0.0005	**0.0009**	One actinolite and one tremolite by SAED/EDX
7/9	272	R1-8	--	--	--	--	**--**	INVALID - not analyzed
7/9	273	R2-8	ND	7	0.0020	0.0015	**0.0035**	Seven actinolite by SAED/EDX
7/8 - 7/9	276	US-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/9	277	US-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/9	278	WB-8	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
7/8 - 7/9	279	UNLS-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/9	280	UNLS-8	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/9	281	EB-8	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
7/8 - 7/9	282	TC-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/8 - 7/9	283	WA-23	--	--	--	--	**--**	OVERLOADED - not analyzed
7/8 - 7/9	284	LN-23	ND	1	0.0004	<0.0004	**0.0004**	One actinolite by SAED/EDX
7/9	285	LN-8	ND	2	0.0010	<0.0005	**0.0010**	Two actinolite by SAED/EDX
7/9	286	EAC-8	ND	3	0.0005	0.0010	**0.0014**	Three actinolite by SAED/EDX
7/9	287	EA-8	1	2	0.0010	0.0005	**0.0015**	Two actinolite by SAED/EDX
7/9	288	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
7/9	289	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
		Daily Total	1	**21**				
				Daily Average	**0.0005**	**0.0006**	**0.0009**	Averages do not include blanks ½ LoD used in calculations for <

Table 28 Daily Concentrations Post Mitigation 7/9 – 7/10

Sampling Date (start - end)	Sample Log#	Sampling Location	Chrysotile Structures	Amphibole Structures	Conc. <5μm (s/cc)	Conc. >5μm (s/cc)	Conc. All Structures (s/cc)	Comments
7/9 - 7/10	290	BC-23	ND	1	0.0005	<0.0005	**0.0005**	One actinolite by SAED/EDX
7/9 - 7/10	291	R1-8	ND	3	<0.0005	0.0013	**0.0013**	Three actinolite by SAED/EDX
7/9 - 7/10	292	R2-8	ND	3	<0.0005	0.0014	**0.0014**	Three actinolite by SAED/EDX
7/9 - 7/10	293	CdS E	ND	2	0.0005	0.0005	**0.0009**	Two actinolite by SAED/EDX
7/9 - 7/10	294	US-23	--	--	--	--	**--**	INVALID
7/9 - 7/10	295	WB-8	ND	3	0.0005	0.0010	**0.0014**	Three actinolite by SAED/EDX
7/9 - 7/10	296	UNLS-23	ND	2	<0.0005	0.0009	**0.0009**	Two actinolite by SAED/EDX
7/9 - 7/10	297	EB-8	ND	2	<0.0005	0.0010	**0.0010**	Two actinolite by SAED/EDX
7/9 - 7/10	298	TC-23	--	--	--	--	**--**	INVALID
7/9 - 7/10	299	WA-23	ND	3	0.0009	0.0005	**0.0014**	Three actinolite by SAED/EDX
7/9 - 7/10	300	LN-23	ND	ND	<0.0005	<0.0005	**<0.0005**	
7/9 - 7/10	301	EAC-8	ND	1	<0.0005	0.0005	**0.0005**	One actinolite by SAED/EDX
7/9 - 7/10	302	EA-8	--	--	--	--	**--**	INVALID
7/9 - 7/10	303TB	Trip Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Trip Blank
7/9 - 7/10	304FB	Field Blank	ND	ND	<0.0005	<0.0005	**<0.0005**	Field Blank
		Daily Total	**ND**	**20**				
				Daily Average	**<0.0005**	**0.0008**	**0.0010**	Averages do not include blanks ½ LoD used in calculations for <

VIII. QUALITY ASSURANCE /QUALITY CONTROL (QA/QC)

A system of procedures, checks, audits, and corrective actions are an integral part of any sampling program to ensure that project design and performance, monitoring and sampling, and technical and reporting activities are of the highest achievable quality. These quality control and quality assurance steps are also needed to identify problem areas and isolate the cause of any contamination. Control checks are permanently recorded to document the quality of the information produced. Written quality control procedures and documents that verify compliance were in place for both sampling and analysis of field samples by way of the protocol and standard operating procedures (SOP). Quality control procedures were implemented throughout the sampling project to ensure that data collected were consistent, relevant, and defensible.

A. Field Quality Assurance/Quality Control

1. Sampler Audits

ARB staff calibrated the flow control valves on the samplers over the range of their intended use prior to and after sample collection. The flow rates through the flow control valves on each sampler were adjusted using a certified mass flow meter such that air flow through the valve was consistent with the flow rate through the certified mass flow meter. Calibrations and flow audit records can be found in Attachment 4.

2. Flow Checks

Flow checks were performed at the start and end of each sampling day for each sampler. Results of flow checks were recorded on the chain-of-custody forms. If the start and end flow rates varied by 25 percent or more, the sample was considered invalid due to unstable flow. Thirty-two out of 266 field samples were invalidated for this reason.

3. Collocated Samplers

Collocated sampling was conducted to establish or verify the precision of the total measurement system for this project. Each sampler of a collocated pair was operationally identical and was run under the same conditions. The samples collected from the primary and collocated samplers were analyzed using the same method. To verify the precision of the airborne asbestos samplers, a collocated pair was operated for a 10 hour duration at the "East A" fenceline site each day and a 23 hour duration pair at the "Cul de Sac East" receptor site each day. Each sampler pair had the same start and end times, total run time, and were situated approximately one meter apart which meets criteria set forth in 40 CFR, Part 58. Results are displayed in Tables 7 and 8 and discussed in Section VI.E.

4. Blanks

Preloaded cassettes were verified as "clean" by the manufacturer prior to use in the field. For each day of monitoring, one trip and one field blank cassette were included with the field samples sent to the laboratory. A trip blank is a sealed filter cassette taken from the box and carried with each sample set. This representative cassette was not opened in the field. The trip blank was analyzed to ensure that no contamination occurred during transport of the filters to and from the sampling site. A field blank is a cassette taken from the box, installed on the sampler, then recapped. Both blanks were labeled and sent to the laboratory for analysis.

There were 18 trip blanks and 16 field blanks analyzed for this project. All blanks had concentrations of <0.0005 s/cc.

5. Chain-of-Custody

Chain-of-custody records were initiated in the field by the field operator and continued in the laboratory for all samples collected. They were used as both field data logs and chain-of-custody documentation. Log numbers were used as unique identifiers given to all samples. Sampler IDs and site names were cross-referenced and recorded on chain-of-custody records. For sample shipment, chains-of-custody were signed, relinquished, and custody seals were used on the shipping containers. No containers or samples were damaged during shipment and the laboratory did not report any unusual conditions upon receipt of samples.

B. Laboratory Quality Assurance/Quality Control

Prior to the start of the El Dorado Oak Ridge High School asbestos mitigation, U.S. EPA Region 9 contracted with Research Triangle Institute (RTI) to produce a tremolite asbestos performance evaluation sample (PE). The PE sample was to be used as an indicator that the CARB contract laboratory had the expertise among their microscopists to identify tremolite asbestos on an ambient air filter sample.

Twenty replicates of the tremolite PE sample were created at RTI; two of which were sent to CARB. CARB forwarded one PE sample to Asbestos TEM Laboratories, Inc. (CARB's contract laboratory) in Berkeley, California, prior to the start of the ORHS project with instructions to analyze the sample using modified AHERA, per the contract Statement of Work (SOW). The second PE sample was submitted to the laboratory in June along with actual air samples collected June 23rd during mitigation of the soccer fields. It was not identified as a PE sample and was in an identical cassette as the field samples. The second PE sample was treated as one of the batch of field samples and analyzed according to the contract SOW using modified AHERA. Results for both PE sample analyses were submitted to U.S. EPA

for evaluation. U.S. EPA personnel indicated the results fell within the 95% confidence interval of a Poisson distribution.[13]

Table 29 PE Sample Results

	Expected	PE #1	PE #2
Chrysotile Structures	0	0	0
Amphibole Structures (average per grid)	0.75 (0-3 range per grid)	1.1	1.7
Structures/mm^2	80	113.4	176.7

In addition to the analysis of the two PE samples, selected samples underwent additional analysis as a laboratory quality control check. A second analyst examined the samples and analyzed either 1) the same grid openings as the original analysis, 2) a new area of the original sample preparation, or 3) a new sample preparation. Twenty-seven samples from this project were subjected to the second party analysis. All of the QC analyses fell within the 95% confidence interval of an expected Poisson variable. Results can be found in Attachment 5.

IX. SUMMARY OF FINDINGS

The relatively low concentrations detected during this study supported the use of procedures defined in the asbestos ATCM. Dust control measures in a known area of NOA reduced emissions from the soccer field and reduced exposures to the receptor sites. In addition, the following observations were made upon review of the data and the study:

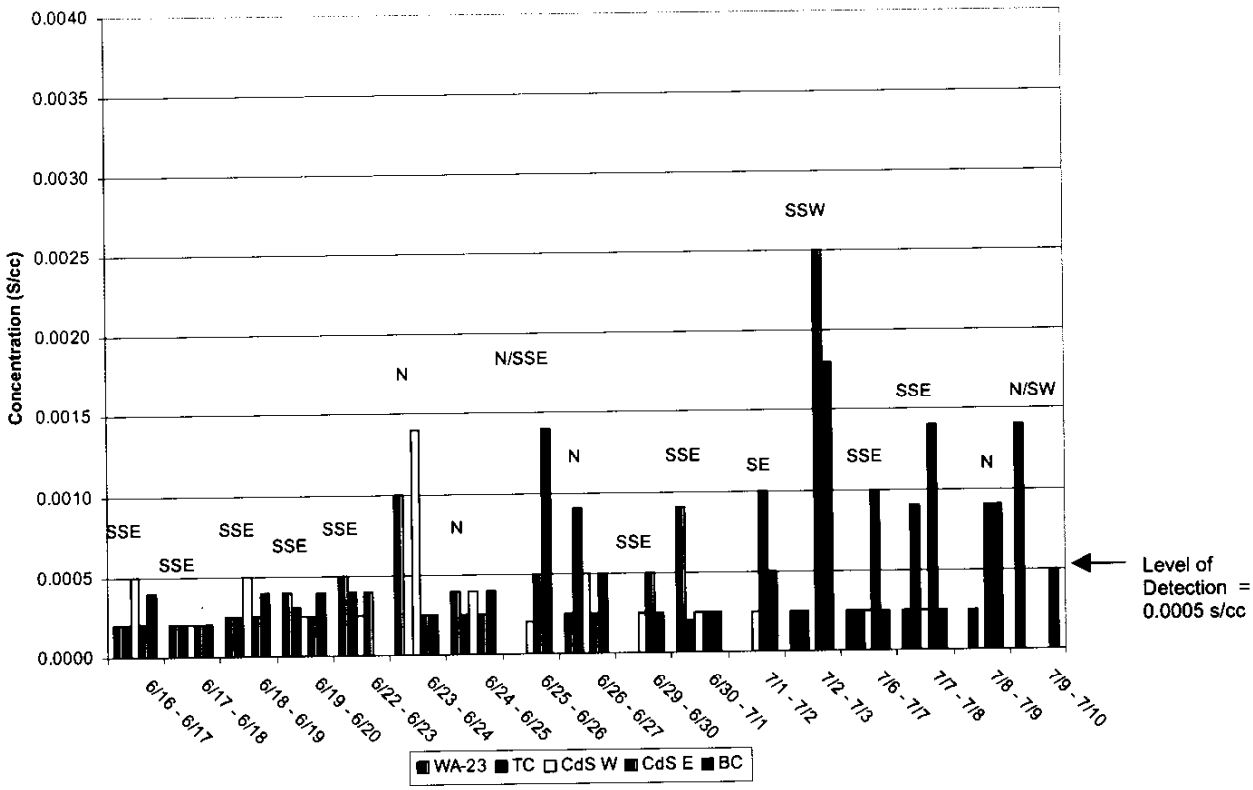
- Of the 224 valid field samples collected, 37 percent had ambient asbestos concentrations below the level of detection (0.0005 s/cc).
- Actinolite, an amphibole, was the prevalent type of asbestos detected at ORHS. Tremolite, anthophyllite, and chrysotile were also found in some samples.
- More than 70 percent of the structures found were greater than 5μm in length.
- The range of asbestos concentrations was from <0.0005 to 0.0039 s/cc.
- The average asbestos concentration among all field samples was 0.0008 s/cc.
- The average 10-hour duration concentration was 0.0010 s/cc and the average 23-hour duration concentration was 0.0005 s/cc.
- Figure 13 shows that:
  - The highest receptor site asbestos concentration was 0.0025 s/cc collected at the Cul de Sac on 7/3/03,
  - The majority of asbestos concentrations (80%) at the receptor sites was below the level of detection,

[13] E-mail dated Aug. 8, 2003, to W. Tasat of ARB from H. Ficklin of U.S. EPA, Region 9

- No single receptor site had more than 5 samples with concentrations above the level of detection during the 17 days of sampling while there was activity on the fields.

Figure 13 Receptor Site Asbestos Concentrations

Receptor Monitors



- The highest fenceline site asbestos concentration was 0.0039 s/cc collected at the upper field access road on 6/24/03.
- The majority of the highest concentration samples was from those collected during activities that intruded into original fill or slopes on the soccer fields or when adding the initial covering of clean fill dirt.

X. References

1. Asbestos TEM Laboratories, Inc., 1409 Fifth Street, Berkeley, California 94710

2. AHERA – 40CFR-Chapter 1-Part 763-Appendix A to Subpart E

3. Confirmed during phone conversation between ARB staff and DTSC staff on 10/21/03. DTSC, 880 Cal Central Drive, Sacramento, California 95826

4. Section 93105, Title 17, California Code of Regulations Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations, www.arb.ca.gov/toxics/atcm/asb2atcm.htm

5. E-mail letter dated August 8, 2003 sent from Hedy Ficklin of U.S. EPA Region 9 to Webster Tasat of ARB